

CONGRESS OF THE UNITED STATES
CONGRESSIONAL BUDGET OFFICE

A
CBO
STUDY

NOVEMBER 1995

Who Pays
and When?
An Assessment
of Generational
Accounting



19970204 030

DISTRIBUTION STATEMENT A

Approved for public release
Distribution Unlimited

WHO PAYS AND WHEN?
AN ASSESSMENT OF GENERATIONAL ACCOUNTING

The Congress of the United States
Congressional Budget Office

NOTE

Cover photo by Gordon Parks shows a four-generation family in Gloucester, Massachusetts, in 1943. (Prints and Photographs Division, Library of Congress)

Preface

The Congressional Budget Office (CBO) prepared this report at the request of the Chairman of the Subcommittee on Long-Term Growth, Debt and Deficit Reduction of the Senate Committee on Finance. The study examines the system of generational accounting, which was developed to show how fiscal policy affects people of different ages--living now or yet to be born.

John Sturrock of CBO's Macroeconomic Analysis Division wrote the study under the supervision of Robert Dennis, Douglas Hamilton, and Kim Kowalewski. CBO analysts Thomas Cuny, Douglas Elmendorf, Jon Hakken, Robert Hartman, Marvin Phaup, Kathy Ruffing, Kent Smetters, and Paul Van de Water made helpful comments and suggestions. Nicholas Dugan, John Romley, and Michael Simpson gave able research assistance.

Outside CBO, David Bradford, Christopher Barker, David Cutler, Robert Haveman, and Michael Weiksner contributed valuable comments and insights. Alan Auerbach, Jagadeesh Gokhale, and Laurence Kotlikoff supplied much data, explained many points, and provided extensive and insightful comments. Marilyn Sorenson of the House Information Systems deserves special thanks for helping to prepare the numerical results. Those outside CBO are not responsible for conclusions expressed or errors that may appear in the report.

Sherwood D. Kohn edited the manuscript. Christian Spoor provided editorial assistance. Dorothy Kornegay, Verlinda Lewis, and Linda Rae Roy typed the drafts. Kathryn Quattrone prepared the study for publication.

June E. O'Neill
Director

November 1995

Contents

	SUMMARY	ix
ONE	INTRODUCTION	1
	The Deficit Does Not Show the Effects of Policy by Age 1	
	Generational Accounts Aim to Show the Effects of Policy by Age 2	
	The Role of Generational Accounts 3	
TWO	ELEMENTS OF GENERATIONAL ACCOUNTS	5
	Forming the Basis of Generational Accounts 5	
	Estimating Tax and Transfer Payments by Age 6	
	Calculating Generational Accounts 12	
	Reporting and Interpreting Generational Accounts 16	
THREE	FINDINGS OF GENERATIONAL ACCOUNTS	19
	Assessing the Evolution and Status of Generational Policy 19	
	Eliminating the Difference in Lifetime Net Tax Rates of Future Generations and Current Newborns 21	
	Assessing Past or Prospective Fiscal Policy 24	
FOUR	UNCERTAINTIES IN GENERATIONAL ACCOUNTS	29
	Sensitivity of Results to Economic and Demographic Assumptions 29	
	Sensitivity of Results to Other Sources of Uncertainty 37	

FIVE	AMBIGUITIES IN GENERATIONAL ACCOUNTS	41
	There Is No Uniquely Right Discount Rate	41
	The Accounts Assume That Prospective Income Is Fixed	44
	Issues Common to Other Tools of Analysis	44
SIX	CONCLUSION	49
APPENDIXES		
A	Is the Zero-Sum Constraint Necessary?	53
B	How Generational Accounts Treat Taxes on Income from Capital	57
C	The Roles of Generational Accounts and the Standard Budget Accounts	59
D	How Generational Accounts Were Developed Under Alternative Economic and Demographic Assumptions	65

TABLES

S-1.	Estimated Lifetime Net Tax Rates by Year of Birth	xi
1.	Estimated Lifetime Tax and Transfer Rates by Year of Birth	20
2.	Distribution of Costs of Hypothetical Policy Changes Needed in 1991 to Reach a Sustainable Policy	23
3.	Alternative Policies That Would Change the Timing or Mix of Taxes and Transfers	26
4.	Alternative Policies That Would Cut the Deficit by an Equal Amount	27
5.	Lifetime Net Tax Rates Under Alternative Economic and Demographic Assumptions	30
6.	Hypothetical Proportionate Cut in Government Purchases Required in 1991 to Reach a Sustainable Policy	32

FIGURES

1.	Taxes Paid by the Average Member of Each Generation in 1991	7
2.	Transfers Received by the Average Member of Each Generation in 1991	8
3.	A Policy That Raises the Deficit: Variation in Results Under Alternative Assumptions	33
4.	Policies That Do Not Affect the Deficit: Variation in Results Under Alternative Assumptions	34
5.	Policies That Cut the Deficit by an Equal Amount: Variation in Results Under Alternative Assumptions	35
6.	Productivity and Its Trends	36

BOXES

1.	How Generational Accounts Treat Taxes and Transfers	9
2.	Tangible Assets of Government	15
3.	Lifetime Labor Income and Lifetime Consumption	17
4.	The Case in Favor of Separate Generational Accounts	21
5.	Would an Updated Version of Generational Accounts Change the Results?	22
C-1.	How Labels Can Affect Measures of Fiscal Policy	60

Summary

Fiscal policy affects future as well as current generations; someone must pay at some time for all that government ever spends. Economists call this condition the "zero-sum constraint"--if one generation pays less for a given amount of spending, another generation must pay more. If government does not retire its debt or reduce its spending, it must impose higher taxes to pay the interest. Either way, someone pays. Thus, fiscal policy transfers resources according to age; it determines how much and when anyone of a given generation will ever pay to government.

But there is no general measure of how fiscal policy affects different generations. The deficit does not; it only records the change in legal claims on government. For instance, if higher payroll taxes paid for higher Social Security benefits, the deficit would not change. But the elderly would benefit at the expense of young and future generations. Similarly, a new policy that did not change the current deficit, but raised prospective deficits, would impose costs on people who had to meet those obligations.

To address such issues, economists Alan Auerbach, Jagadeesh Gokhale, and Laurence Kotlikoff propose a system they call generational accounts. The system can be used to estimate the net amount that the average person of any age today would ever pay government under a given policy. Thus, the accounts add to the box of tools for policy analysis; they try to measure how policy directly affects people by age. They also offer insight into important issues, including long-run solvency, the prospects of future generations, and the cost of risk in choosing policy.

Despite their ambitious scope, generational accounts are limited in important ways. They depend on calculations that are not only empirically uncertain but theoretically ambiguous. Moreover, the accounts take prospective income as a given, although the effect of policy on young and future generations depends greatly on how it affects income. Similar issues arise with many commonly used tools of analysis. But ambiguity and omission of the effects of policy on income undermine the ambitious claim that the accounts describe the generational effect of fiscal policy, especially for future generations.

Should generational accounts supplement the regular presentation of the budget outlook by the Congressional Budget Office (CBO)? CBO concludes that, despite the valuable insights generational accounts afford, they should not become part of the regular budget outlook. They lie in the realm of analysis, not accounting. Therefore, CBO believes that the accounts should remain as a tool to analyze policy from a conceptual perspective, rather than serve as an official statement.

What Are Generational Accounts?

Generational accounts estimate who pays for all that government ever buys. Such purchases are used to provide defense, build roads, educate children, and so forth. People pay for those purchases with net taxes --that is, taxes less transfers (government payments, such as those for Social Security or welfare). The

accounts, therefore, estimate the real (that is, inflation-adjusted) net taxes ever to be paid by the average member of each generation (today's newborns, one-year olds, and so on). They also estimate the net taxes of the average member of the representative future generation (those not yet born). The accounts do not try to estimate who benefits from what government buys, only who pays for it with their net taxes.

How Generational Accounts Are Constructed

The accounts rely on two standard ideas--"present value" and the zero-sum constraint. Present value expresses a stream of net payments over time by what they would be worth if they were all paid at a given date as one sum. To calculate present value, the accounts must use an interest rate to discount all net payments to the given date. Using present value makes it possible to compare net taxes of various generations on a common basis.

The zero-sum constraint specifies that future generations must pay with interest for purchases that past and current generations do not pay for. The constraint may be expressed as an equation: the present value of net taxes of future generations must equal the current value of government debt, plus the present value of all prospective purchases by the government, less the present value of net taxes of current generations.

Using these ideas, generational accounts address a hypothetical question: if policy remained as it is for current generations for the rest of their lives, how much would they pay in net taxes, and how much would future generations have to pay? Thus, the accounts do not try to predict the actual course of policy; instead, they ask an "as if" question to reveal what policy now implies. In that respect, the accounts resemble other standards. For example, the baseline budget establishes a reference point as if current policy were to remain in force for the next 10 years for everyone, alive now or born later.

To answer their "as if" question, the accounts project government purchases and net taxes of cur-

rent generations and calculate their present values. Given the level of government debt in the base year, the accounts then calculate the present value of net taxes of future generations through the zero-sum constraint (or equation). The procedure depends on economic and demographic projections, assumes a discount rate, and requires a policy rule that determines taxes and spending for current generations according to age.

Projecting Net Taxes of Current Generations. In order to project the net taxes of current generations, the accounts start from official projections of taxes and spending. The projections are then mechanically extended to estimate the net taxes of the average members of all current generations for the rest of their lives.

The accounts break net taxes into broad components because each particular tax or transfer varies with the age of the payer or recipient. Taxes are grouped into those that apply to sales, payroll, labor income, capital income, or homes. Transfers are grouped with Social Security, Medicare, Medicaid, Aid to Families with Dependent Children, Food Stamps, unemployment insurance, or general welfare payments.

The method supposes that the net taxes of current generations will continue to depend on age as they do now. For example, the accounts assume that the average 30-year-old man will always pay three-quarters as much in income taxes as the average 40-year-old man. (The extensions for Social Security benefits, however, reflect the prospective changes provided for by current law.)

Given such relationships and a projection of population, the accounts can take an official projection of total net taxes in each year and convert it into an amount for the average person of each generation. Such annual amounts can then be extended, depending on assumptions for productivity (output per worker) and population growth. A discount rate is then applied to find the present value of net taxes of all current generations and of the average members of each current generation.

Unlike a baseline budget projection, the accounts do not assume that the law remains unchanged when

they extend taxes and transfers. Instead, they assume that after the projection period, all taxes and transfers for the average person (now alive) of a given age would grow at the same rate as output. For example, the accounts assume that the Congress would index all transfers to people now living for increases in inflation and productivity, whereas only some transfers are so indexed by current law. For that reason, CBO refers to the policy assumptions in the accounts as "prevailing policy" rather than current policy.

Applying the Zero-Sum Constraint and Expressing the Results. A projection of purchases is the last element needed to apply the zero-sum constraint. Purchases are projected in a manner similar to that for net taxes of current generations. That is, total purchases are first taken from an official projection, then extended on the basis of population and productivity. Unlike the rules for net taxes of current generations, the rules for purchases apply to future generations as well (because the accounts ask who pays for all purchases that policy determines). Given projected purchases, the accounts apply a discount rate to find the present value of the purchases.

The net taxes of future generations can then be found through the zero-sum constraint, given net government debt and the present values of purchases and net taxes of current generations. By assuming that all future generations pay net taxes at the same rate, the accounts can speak of a representative future generation.

The results of the accounts may be stated in terms of the "lifetime net tax rate" of a given generation. That rate is the present value at birth of net taxes paid over a lifetime as a percentage of the present value at birth of labor income earned over a lifetime. (Lifetime labor income is used as the base because it is closely related to lifetime consumption.) That concept requires estimates of both past and prospective net taxes in order to compare members of all generations on the same basis. Historical totals for net taxes are converted into net taxes of each generation in the same manner that projected totals are converted.

Results of Generational Accounts

Given past and prevailing policy, lifetime net tax rates have risen during the century and would rise much further for future generations (see Summary Table 1). Under the assumptions used in the accounts, the estimated rates have risen from 24 percent for those born in 1900 to 37 percent for those born in 1990. (Those figures include net taxes at all levels of government--federal, state, and local--but do not include the effects of any policy change under

Summary Table 1.
Estimated Lifetime Net Tax Rates by Year of Birth (Average for males and females, in percent)

Year of Birth	Net Tax Rate ^a
1900	24
1910	28
1920	29
1930	31
1940	32
1950	34
1960	35
1970	36
1980	37
1990	37
Future Generations	78

SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: The rates shown are for net taxes at all levels of government combined--federal, state, and local.

The estimates assume a real discount rate of 6 percent, a prospective annual rate of growth in productivity of 0.75 percent, and the midgrowth path of population used by the Social Security Administration in its 1993 annual report.

The values in the table reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

- a. A lifetime net tax rate is the present value at birth of lifetime net taxes as a percentage of the present value at birth of lifetime labor income. Net taxes are taxes less transfers.

consideration.) Most of that increase has paid for a similar rise in the rate of government purchases from 1900 to about 1950. But to enjoy the now-prevailing rate of purchases in relation to income, future generations would have to pay lifetime net taxes at a rate of 78 percent. That is more than twice the rate for today's newborns.

That outcome agrees with results from traditional analysis, which also show that tax and spending policy cannot remain as they are. For example, the General Accounting Office estimates that with no change in policy, the federal deficit would exceed 20 percent of gross domestic output in 2025, and the federal debt would exceed 200 percent. (The corresponding figures in 1994 were 2 percent and 53 percent.) Similarly, the Social Security and Health Care Financing Administrations project that current policy would exhaust the trust funds for Social Security and Medicare.

Those projections and generational accounts represent different ways of showing that current policy is not "sustainable." That is, tax or spending rates must change for someone at some time; they cannot remain as they are. The budget projections show that federal debt would get out of hand if policy continued as is for everyone, alive or yet to be born. The accounts show that future generations would have to pay net taxes at higher rates than current newborns in order to redress fiscal imbalance if policy stayed as it is for those alive now.

Of course, neither lifetime net tax rates of nearly 80 percent nor a debt more than twice as large as domestic output is at all likely. Most people expect policymakers to make the tough choices needed to put the nation's fiscal house in order. Generational accounts and long-term budget projections are two ways of showing numerically the implications of inaction.

Generational accounts, however, may not always tell the same story that the deficit would seem to tell. Furthermore, they can address questions beyond sustainability. For example, most analysts agree that since World War II, fiscal policy has transferred resources from young and future to old generations. Surprisingly, the accounts indicate that most of that transfer occurred from the 1950s through the 1970s

when deficits were low, rather than since that time when deficits have been high. The main reason for the transfer is that the Congress raised payroll taxes to pay for higher benefits for Social Security and Medicare, thus increasing the obligations of young and future generations.

In the years ahead, the Congress could reduce the net taxes of future generations in ways that could have very different effects on living generations. For example, prospective Medicare benefits could be reduced by cutting benefits now or by raising the age of eligibility. Cutting benefits would fall harder on those who are now 65 or older; raising the age of eligibility would fall harder on those who are under 65. Or raising payroll taxes would harm workers (mostly young); raising taxes on capital income would harm owners (mostly old). Generational accounts estimate the amounts by which any change in policy would help or hurt the average members of each generation.

Interpreting Generational Accounts

Generational accounts act as a gauge, not a predictor or goal. They do not try to say how policy will actually evolve. And they cannot say what distributions are fair; that is a matter for policy, not analysis. The accounts serve only as a norm by which to evaluate prevailing policy and compare alternative policies.

In order to use them as a norm, lifetime net tax rates must be kept in perspective. Such rates seem high when compared with "current net tax rates" (current net taxes as a percentage of current market income). For example, the current net tax rate for the nation is 24 percent, whereas the lifetime net tax rate of today's newborns is 37 percent under prevailing policy.

But current net tax rates do not compare people of different generations on the same basis. People typically pay most of their taxes and receive little in transfers when they are young or middle-aged, so their current net taxes are high. The old typically receive more in transfers than they pay in taxes, so their current net taxes are not merely low but negative. Current net tax rates do not reflect net taxes that the young will pay or the old have paid, and the cur-

rent net tax rate for the nation combines net taxes of the young and old.

Lifetime net tax rates do compare people of different ages on the same basis because such rates are computed from birth. They are high compared with current net tax rates for a number of reasons. First, present value at birth gives more weight to a dollar of tax paid early in life than to a dollar of transfer received late in life. Second, some people born in a given year will live long enough to pay taxes, but not to receive transfers, thus raising the lifetime net tax rate of the average person born in that year. Finally, lifetime net tax rates are based on labor income rather than total income, as are current net tax rates. Using the smaller measure as a base makes lifetime net tax rates higher.

In any case, lifetime net tax rates are estimates that depend on uncertain and debatable assumptions. Furthermore, such rates do not include many other factors that are relevant to a consideration of distribution by age. Hence, generational accounts can serve only as rough guides for comparison, not as hard and fast standards.

Contributions of Generational Accounts

Generational accounts represent a significant effort to fashion a new tool of analysis. How fiscal policy distributes resources among generations is interesting in itself. It is also important because the way that people respond to policy depends on their age, among other factors. The accounts highlight what is known about how policy distributes resources by age and what is left to learn.

The accounts also command attention for other important issues that they raise. By incorporating the zero-sum constraint, they frame issues in terms of ultimate limits on the government budget. The approach focuses on policy that can be sustained and enables the accounts to represent current and future generations on a comparable basis. Unless policy-makers explicitly consider the interest of future gen-

erations, there is no reason those generations are sure to be suitably represented.

Moreover, the accounts underscore the cost of risk in undertaking government programs--a cost that the interest rate on government debt fails to incorporate. Ignoring such risk could bias policy choices by lending too much weight to estimates of prospective costs and benefits. For instance, the Congresses that raised benefits for Social Security and Medicare believed that revenues would match the higher obligations, although they have not. The belief that they would was based in part on analysis that effectively used the interest rate on government debt as a discount rate, thereby ignoring some of the risk in undertaking the higher obligations.

Limitations of Generational Accounts

Many factors render the accounts uncertain or debatable. Most of those problems are common to other means of analysis. But some represent limits of economic analysis that will remain intractable and require compromises. For those reasons, the accounts can yield only broadly defined results and in some cases may even mislead.

Problems Typical of Most Economic Measures

Problems that are common to economic analysis arise from uncertainty about economic and demographic projections or about estimates of who effectively pays taxes and receives transfers. Furthermore, as with most economic measures, the accounts do not address some issues that are relevant to distribution by age.

Uncertainty About the Economy and Population. In one sense, the accounts can deliver only qualitative results, even though they are expressed in quantitative terms. The results can vary widely with different assumptions about population, productivity, and the discount rate. For example, given the base as-

sumptions of the accounts, prevailing policy implies that future generations would pay lifetime net taxes at a rate 41 percentage points higher than that of today's newborns. Under a reasonable range of assumptions, however, that figure could vary from 12 percentage points to 116 percentage points. Such variation implies that future generations would pay net taxes at a lifetime rate between 44 percent and 242 percent higher than that of current newborns.

Such variations are typical of the uncertainty that plagues any long-term projection. To deal with that kind of uncertainty, the Social Security and Health Care Financing Administrations present projections for their trust funds as probable ranges that exhibit substantial variation. For instance, under the assumptions that it considers most probable, the Social Security Administration projects that its trust fund would be exhausted in 2030. But under plausibly optimistic assumptions, trust fund balances would grow indefinitely.

Those sources of uncertainty do not undermine the main implication of generational accounts: that prevailing policy is biased against the future. Moreover, the results display much less dispersion for living generations, suggesting a rough magnitude and general pattern.

But the uncertainty leaves a wide quantitative margin for policymakers to consider. And many other sources of uncertainty contribute further to that margin--for instance, rates of participation in the labor force, distributions of earnings by age and sex, differences in medical requirements by age, requirements for defense, and so forth.

Uncertainty About Who Pays or Benefits. The accounts depend on uncertain estimates of how policy affects people by age. Deciding who effectively pays a given tax or receives a given transfer rests on imprecise empirical estimates.

Who effectively pays taxes on capital income is especially uncertain. The accounts assume that owners of capital pay the tax, but part of it may be passed on to workers as lower wages. Moreover, it is not clear how changes in investment incentives, such as accelerated depreciation or tax credits, affect the value of assets. According to the theory on which the

accounts rest, raising such incentives would transfer resources from the old to the young because they effectively make new capital cheaper than old. But if it is costly to adjust to new desired levels of capital, more generous incentives could benefit owners of existing firms, which are better prepared to undertake investment. Indeed, some evidence suggests that an increase in investment incentives would transfer resources from prospective owners (mostly young) to current owners (mostly old)--just the opposite of what the accounts assume.

Even less is known about who effectively receives transfers. The scant evidence that exists for Social Security suggests that direct beneficiaries may enjoy nearly all the benefits of an extra dollar. But little work has been done on the subject. Furthermore, much of an extra dollar for health care may benefit third parties--often relatives or those with private insurance--to whom the cost would have passed otherwise.

Relevant Issues That Are Not Addressed. The accounts do not consider many ways in which policy can distribute resources among generations. Most important, the accounts estimate who pays for what government buys, but do not estimate who benefits. Nor do they consider how inflation and regulation can benefit some generations at the expense of others. In particular, unexpected inflation reduces the real value of government debt and shifts costs from future generations to current holders of the debt. Furthermore, the accounts do not consider how policy distributes resources among income groups, either within or between generations. (It would be possible, however, to adapt the accounts to reflect distribution by income.)

Such omissions are common to most economic measures or tools of analysis. For instance, the national income and product accounts neither estimate the real value of services that government buys nor address any of the other issues raised above. Indeed, there is no general estimate of the economic value of services provided by what government buys, in part because they serve functions that private markets do not. Although knowing who pays for purchases answers half of the questions about their distribution by age, such omissions make it necessary to interpret the results with care.

Special Problems of Generational Accounts

Generational accounts have two particularly serious problems. First, the role of the discount rate raises unresolved questions. That issue is especially important because different choices of discount rate lead to most of the variation in results. Second, the accounts assume that fiscal policy has no effect on potential income. Although that assumption is reasonable in the short run, it becomes less so in the long term. Moreover, the accounts have a horizon that is very distant--indeed, it is infinite.

Neither of those problems weakens the qualitative conclusion that prevailing policy is not sustainable. But they leave any quantitative results open to question, especially for future generations.

Ambiguity About the Discount Rate. Questions about which discount rate to use are basic because such a rate is needed to calculate the present values of lifetime net taxes. In simple terms, a discount rate is often thought to represent the cost of waiting--that is, postponing income or consumption. In generational accounts, however, the discount rate also reflects the cost of uncertainty--the risk that income may be lost rather than merely postponed. But choosing a discount rate to reflect the additional cost requires many compromises between the real and ideal.

To begin with, the accounts assume that the same discount rate applies to all net taxes of all generations, although that assumption is not likely to be strictly warranted. For instance, the old may view their prospective Social Security benefits as more secure than do the young; but the young may feel better able to undertake risk. And because any generation will be richer than its predecessors, it would assign less cost than they do to the same probability of losing a given amount of net income. Thus, there is no reason to expect all generations to attach the same premium for risk to prospective payments or receipts of each tax or transfer.

Furthermore, analysts could not estimate the right discount rate very well, even if a single rate were right in all cases. People cannot trade claims on

prospective taxes and transfers in markets the way they can trade claims on prospective income from stocks or bonds. Therefore, it is not possible to use market information to infer the premium for risk that people attach to prospective net taxes.

It might be difficult to infer a risk premium even if there were markets in prospective taxes and transfers. For example, the discount rate of 6 percent that is used as a base case in the accounts is equal to the average rate of return on equity. But that rate is much higher than economists can explain on the basis of equity risk. Moreover, some people--especially among the young--would not be able to express their preferences in the market if they could not borrow against their prospective income from labor or transfers.

The Assumption That Prospective Income Is Given. Fiscal policy can affect prospective pretax income in two ways that the accounts do not reflect. Government borrowing displaces private assets that produce income, and net taxes affect people's decisions to work, save, hire, and invest. Therefore, for example, cutting current and prospective deficits would raise prospective income, especially for young and future generations. Similarly, replacing an income tax with a consumption tax would lead to more investment and higher prospective income. By taking pretax income as given, the accounts overstate the cost to young generations of cutting the deficit or switching the tax base and conversely underestimate the gain to future generations.

The assumption of fixed income is common, but the ambitious scope of generational accounts makes the premise more important. For instance, government agencies regularly estimate the 10-year budgetary effects of proposed changes in fiscal policy as if they would have no effect on pretax income. That procedure greatly simplifies comparisons of alternative policies and does not introduce large errors because the time horizon is short. Long-term projections by the Social Security Administration also assume no feedback from policy to national income, but they only refer to one element of the budget. By contrast, generational accounts try to present a comprehensive view of fiscal policy indefinitely.

Taking income as given introduces little error for most generations but sizable error for young and future generations. For example, the accounts might overstate the effect of deficit reduction by about 25 percent for current newborns and underestimate it by about 65 percent for generations far in the future. Put

another way, the accounts would overstate by a multiple of three the costs that current adults would have to undergo to equalize the treatment of future generations and current newborns. That is a serious problem for a system that attempts to represent current and future generations on the same basis.

Chapter One

Introduction

Among its other effects, fiscal policy distributes resources among generations. That is, it determines how much a person of any age today will ever pay for what government spends. What policy implies for people of different ages is intrinsically interesting. Moreover, it is important to know because the way that people respond to policy depends on their age, among other factors. Finally, current policy affects the well-being of both current and future generations (those yet unborn). But the unborn cannot bargain with the living. Unless policymakers explicitly consider the interests of future generations, there is no reason to assume that those generations will be suitably represented.

Nevertheless, no general tool of analysis estimates the amounts of resources that fiscal policy transfers among generations. In particular, the deficit does not, although it may seem to do so.

The Deficit Does Not Show the Effects of Policy by Age

The deficit records the increase in government debt held by the public--that is, legal obligations that people buy with cash and will present for payment later. The cash from issuing debt pays for current government spending in excess of revenue. As a measure of that excess, the deficit shows how much government reduces current national saving, other things being

equal. (A higher deficit would not reduce national saving if the extra cash was used to add to national assets, such as knowledge, public health, or useful government capital. High deficits of the past 20 years have not been used to do so, however.)

The reported deficit may seem to suggest what policy implies for the future. A deficit can transfer resources by age if it is used to consume more now and let later generations pay. Moreover, the higher public debt that is recorded by the deficit crowds out private assets because both compete for the same supply of funds. The private assets that are displaced would have produced income later. With more debt and fewer assets, future generations could inherit the mortgage instead of the house.

But the deficit need not show what implications policy has for any generation because tax and spending programs affect people of different ages differently, and the current deficit does not record implicit obligations.

Tax and Spending Programs Affect People of Different Ages Differently

Tax and spending programs do not affect people of all ages uniformly. For instance, Aid to Families with Dependent Children directly helps the young, whereas Social Security directly aids the old. Similarly, payroll taxes fall harder on the middle-aged because they earn more labor income, whereas

corporate taxes fall harder on the old because they own more assets.

Therefore, fiscal policy could transfer resources among generations whether the deficit rose or fell. For example, an increase in Social Security benefits paid for by a payroll tax would not change the deficit. But the policy would aid those who are in or near retirement at a cost to all others, alive or yet to be born.

The Current Deficit Does Not Record Implicit Obligations

Government has implicit obligations that do not show up in the current debt or deficit. For example, today's debt does not reflect how much it will cost to pay Social Security benefits under current law when the baby boomers retire. Deficits of the past 30 years would have been much higher than those reported if they had included increases in such implicit liabilities. By contrast, a cut in Medicare benefits that is scheduled for the future would not change the deficit now but would reduce it later. And a scheduled cut in tax rates would raise prospective deficits. Thus, policy choices made at one time may not show up in the deficit until later.

In a sense, all of the government's prospective spending is an implicit liability. That is, people expect government to provide a legal system, national defense, public works, education for the young, a safety net for the poor, an income floor for the old, and so on. Similarly, prospective revenue is an implicit asset of government because people expect to pay taxes to finance such spending.

The deficit does not record such implicit obligations because they do not represent binding claims. For example, retirees have no legal claim to the Medicare benefits they expected when they retired. Technically, the Congress could reduce the benefits at any time, even though people had planned on receiving higher benefits.

Nevertheless, government has a duty to try to meet its implicit commitments. It could not capriciously change taxes or benefits without losing its

reputation for keeping its implicit word and treating people fairly. The ability to govern ultimately rests on such a reputation.

Even if the deficit did record changes in such implicit liabilities and assets, it would not reveal distribution by age. It would only show a total for government; it would not show what that implied for the average person of a given age today.

Generational Accounts Aim to Show the Effects of Policy by Age

To gauge the effects of policy by age, economists Alan Auerbach, Jagadeesh Gokhale, and Laurence Kotlikoff propose a system they call generational accounts.¹ That system estimates, under a given policy, how much and when the average person of any age today would ever pay in taxes or receive in benefits. The system also estimates the implications of that policy for the net payments of people born in the future.

Generational accounts go beyond proposals to adjust the unified budget deficit at the federal level to account for various factors. Those factors include inflation, economic growth, interest costs, the value of government assets, or the phase of the business cycle. Such adjustments are intended to help show the amount of fiscal stimulus or put the debt in perspective. But the adjustments would not reveal how fiscal policy distributes resources by age.

By contrast, generational accounts aim to record all obligations that a policy undertakes and to estimate how it directly transfers resources among people of all ages, including future generations. Thus,

1. See Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110; and Laurence J. Kotlikoff, *Generational Accounting: Knowing Who Pays, and When, for What We Spend* (New York: The Free Press, 1992).

the accounts address issues that the deficit does not and add to the box of tools for policy analysis.

The Role of Generational Accounts

Should generational accounts supplement the regular presentation of the budget outlook by the Congressional Budget Office (CBO)? To consider that question, CBO examined how the accounts are constructed; how they are to be interpreted; what questions they can address; and how quickly, completely, and accurately they can do so.

CBO concludes that the generational accounts should not be a regular part of its presentation of the budget outlook. By addressing distribution by age, the accounts contribute valuable insights to the analysis of fiscal policy. They also provide a new focus on important issues, including those of long-run solvency, the cost of risk in choosing policy, and prospects for the future. Despite their name, however, the accounts are best seen as an exercise in analysis, rather than as an accounting report. CBO believes, therefore, that generational accounts should remain a tool for analyzing policy rather than serving as an official statement.

Elements of Generational Accounts

Generational accounts estimate who will pay for all that federal, state, and local governments will ever buy under a given policy. Such purchases are used to provide defense, build roads, educate children, and so forth. People pay for those purchases with net taxes--that is, taxes less transfers (government payments, such as those for Social Security or welfare). The accounts estimate the real net taxes ever to be paid by the average member of each current generation (today's newborns, one-year olds, and so on). They also summarize the real net taxes of the average members of future generations (those born next year, the year after that, and so on). The accounts do not try to estimate who benefits from what government buys, only who pays for it with their net taxes.

To do so, the accounts start from the premise that all government purchases must be paid for--either at the time with taxes, or later by retiring debt or paying interest. Therefore, the net taxes that current generations pay under a given tax and spending policy will determine the net taxes of future generations.

Finding the implications of a policy for people of different ages requires first estimating how that policy relates their taxes and transfers to their age. Given such relationships, the accounts extend official economic, budget, and population projections to estimate the net taxes of all current generations for the rest of their lives. Those net taxes will determine the bill that future generations will have to pay, given what government will ever buy under that policy.

Thus, the accounts pose a hypothetical question: if a given policy applies to all current generations for the rest of their lives, what would that imply for the net taxes of current and future generations? The answer to that question does not predict actual policy, but is an abstract indicator of how today's policy would distribute resources among generations.

Forming the Basis of Generational Accounts

Two standard ideas form the foundation of generational accounts: "present value" compares payments at different times on the same economic basis, and the "zero-sum constraint" enforces government solvency in the long run.

Present Value

Present value puts the prospective net taxes of the average person of every age on the same basis--one payment at one time. It is the net amount that an individual is willing to pay at that time, then never again pay taxes or receive transfers.

A discount (interest) rate is used to calculate present value. For instance, if the interest rate is 5 percent, this year's \$100 will grow to \$105 next year. Hence, \$100 is this year's present value of \$105 next

year; alternatively, \$105 is next year's present value of \$100 this year. Other things being equal, present value gives less absolute weight to a prospective dollar if:

- o The discount rate is higher (because a smaller amount can grow to a dollar in a given time when it compounds at a higher rate), or
- o The payment is later (because a smaller amount can grow to a dollar at a given rate when it compounds for a longer time).

The Zero-Sum Constraint

The zero-sum constraint says there is no free lunch; someone, sometime, must pay for all that government ever spends. That is, the present value of prospective net taxes of all current and future generations must match today's net government debt (liabilities less assets), plus the present value of all prospective government purchases. Purchases that past and current generations do not pay for, future generations must, and with interest.

The zero-sum constraint ensures that government debt cannot forever grow faster than output. Without the constraint, mounting interest costs could swell the debt beyond control and bring on default, either direct or by inflation. (Of course, the constraint is satisfied even if government defaults--then the bondholders pay.)

The zero-sum constraint does not specify that government must ever retire any of its debt or can borrow no more; only that it cannot borrow forever to pay interest. If it could, the bill for a deficit would never come due; each generation could pass the bill to its children, who could pass it to its children, and so on. If government cannot borrow forever to pay interest, it must raise taxes or reduce spending at some time, either to retire debt or pay interest forever--choices that are equivalent in present value.

Some conditions may allow the bill to be passed on forever, but they do not prevail now. It may be feasible to pass the bill if the rate at which output grows is forever greater than the rate at which gov-

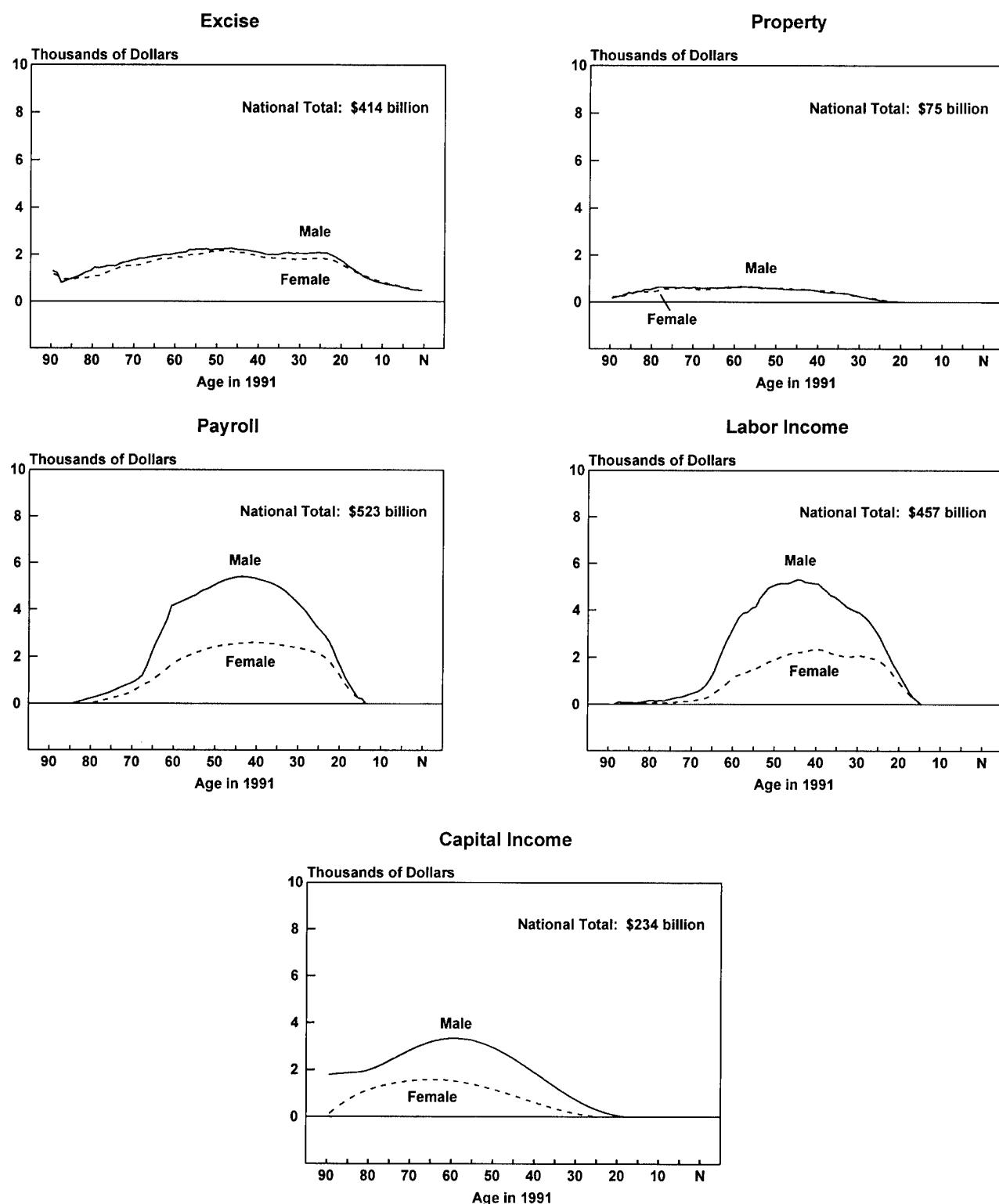
ernment pays interest on debt. (Even then, the non-interest part of the deficit must stay within a limit in relation to output.) But current and prospective interest rates are too high for that policy to work; and even if they were not too high now, they may become so later. Therefore, trying to evade the constraint and pass the bill is at best a gamble that exposes current or future citizens to the risk of higher net taxes than expected (see Appendix A). Of course, the borrowing crowds out private assets even when the gamble succeeds.

Estimating Tax and Transfer Payments by Age

The first step in carrying out the ideas behind the accounts is to find how taxes and transfers are now related to age. The average amount of any tax or transfer can vary greatly by age and sex (see Figures 1 and 2 and Box 1). By the estimates in the accounts, those who pay the highest taxes on income from labor are a bit over the age of 40; those who pay the highest taxes on income from capital are about 60 years old. Excise and property taxes fall more evenly on all age groups. Most Social Security and Medicare benefits go to those who are 65 or older, and benefits from Medicaid and other transfers appear more evenly distributed.

The profiles of taxes and transfers by age that are shown in Figures 1 and 2 reflect the judgments used in making them, not necessarily judgments that the Congressional Budget Office would make. Moreover, the profiles shown reflect an outdated version of the accounts, which contains errors that have since been corrected. The profiles shown for Medicare and Medicaid wrongly exclude disabled people who are younger than 65 or in nursing homes. Such people now receive about 16 percent of all Medicare benefits and 28 percent of all Medicaid benefits. For Medicare, the exclusions make the profile of those older than 65 too high in relation to that of younger people; for Medicaid, the profile is too low. As a practical matter, the exclusions have little effect on the main results considered later.

Figure 1.
Taxes Paid by the Average Member of Each Generation in 1991



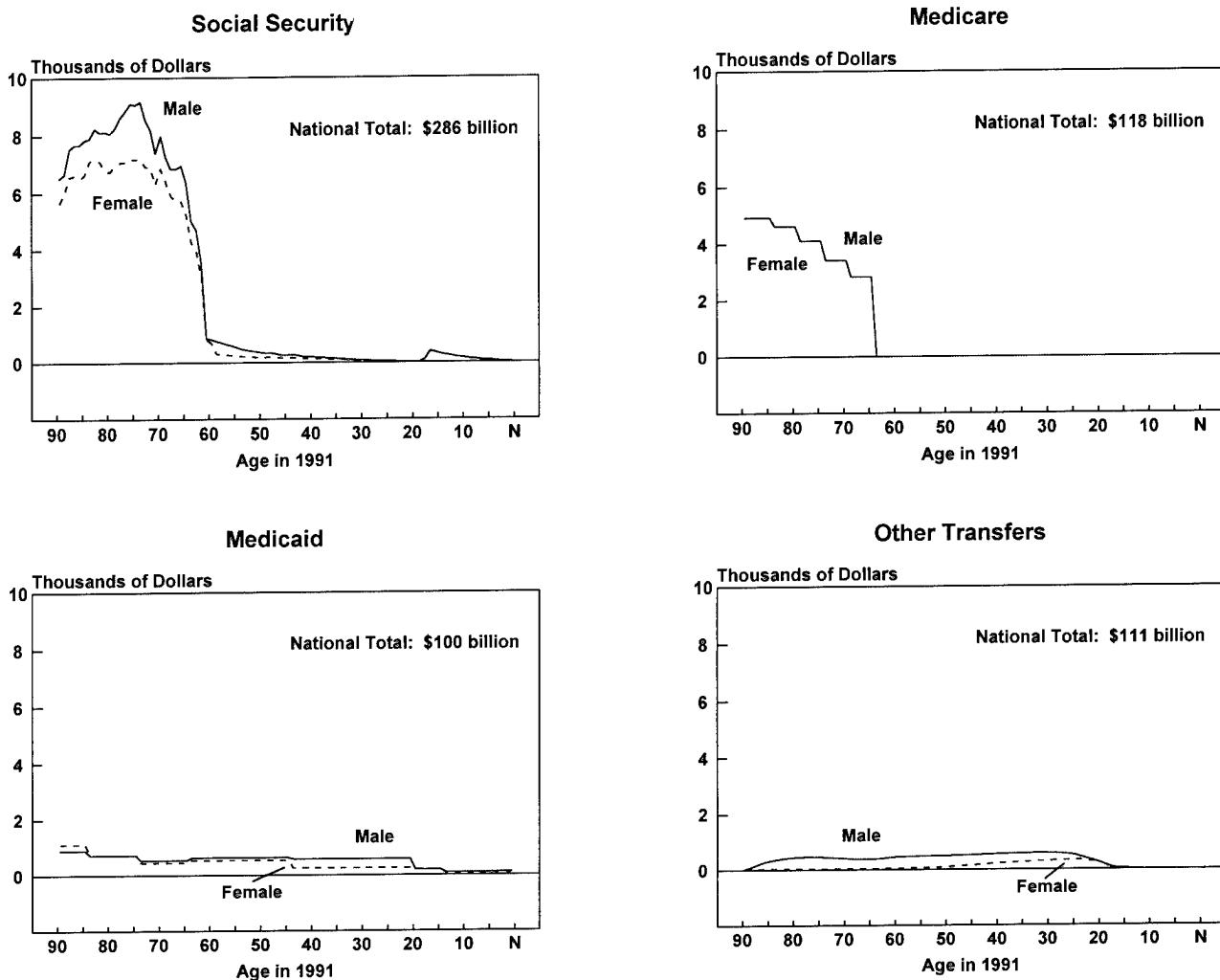
SOURCE: Congressional Budget Office, using data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTE: N = newborns.

The accounts do not use the profiles in absolute terms, but as "relative-age profiles." For example, compared with the average 40-year-old man, the average 60-year-old man pays 66 percent as much in payroll taxes; the average 40-year-old woman, 46 percent as much; and so on. Such relationships are assumed to remain fixed. Given the relative-age profiles and population by age, the national total for any

tax or transfer can be converted into an amount for the average person of any age and sex. The reverse is also true--that is, amounts per person can be converted to a total. Consequently, for example, total payroll taxes would fall if there were fewer 40-year-old men and as many more 60-year-old men, other things being equal.

Figure 2.
Transfers Received by the Average Member of Each Generation in 1991



SOURCE: Congressional Budget Office, using data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: The profiles shown reflect judgments made in constructing generational accounts, not necessarily judgments the Congressional Budget Office would make. The profiles have been updated in the latest version of generational accounts using more recent data or new data sources.

N = newborns.

In order to construct the relative-age profiles, the accounts start from official survey data. They also need to decide what to assume about the "incidence" of each tax and transfer; that is, who effectively pays or receives the cash value of a given tax or transfer? For economic or social reasons, that may not be the legal payer or recipient. Special assumptions are also needed to assign taxes on capital income and taxes and transfers within families.

Using Survey Data

The Current Population Survey, conducted by the Bureau of the Census, was used to estimate average labor earnings at any age in 1988. The accounts assume that people pay payroll and labor income taxes in proportion to their income from labor. Labor income includes the implicit labor income of proprietors, as well as the compensation of employees.

Box 1. How Generational Accounts Treat Taxes and Transfers

Generational accounts broadly consider five groups of taxes and three groups of transfers to persons. Taxes comprise:

- o Excise taxes, which consist of sales taxes, tariffs, and property taxes paid by all businesses, including farms;
- o Property taxes on owner-occupied homes;
- o Payroll taxes, which consist of both employees' and employers' shares for social insurance and include the contributions of government workers to their pension funds;
- o Taxes on labor income, which consist of income taxes paid on the income from labor of workers and proprietors; and
- o Taxes on capital income, which consist of corporate income taxes (excluding taxes paid by the Federal Reserve System), estate taxes, and income taxes paid on the capital income of proprietors, investors, and lenders. The category also includes seigniorage--a minor item that represents the revenue obtained from issuing money.

Transfers to persons comprise:

- o Social Security, which consists of Old-Age and Survivors Insurance and Disability Insurance (less federal income tax paid on such benefits), Railroad Retirement, and Supplemental Security Income;
- o Health, which separately treats Medicaid and Medicare (less premiums for Part B); and

- o Other transfers, which treats separately Aid to Families with Dependent Children, Food Stamps, unemployment insurance, and general welfare. The earned income tax credit is included with Food Stamps.

Traditionally, transfers are defined as payments for which the government does not receive a current good or service in return. People may receive them under entitlement programs, such as Medicare, or under discretionary programs, such as the Special Supplemental Food Program for Women, Infants, and Children.

In some cases, however, the accounts do not define taxes or transfers to persons in the usual way. For example, they treat personal nontax receipts--such as licenses and user fees or tuition and hospital charges--as returns on government assets rather than taxes. As a result, such fees are netted from both taxes and government purchases in the accounts.

Similarly, medical, disability, and retirement benefits for civil service and military personnel and veterans are treated in the accounts as purchases (compensation of employees) rather than transfers. That treatment supposes that the government makes such payments as deferred compensation for past service under previously agreed terms.

Finally, payments that are not conventionally considered either purchases or transfers to persons must be dealt with. The accounts treat as purchases both government transfers to foreigners (mostly foreign aid) and subsidies less current surpluses of government enterprises. Payments of net interest on public debt need not be treated explicitly because they are implied in the process of discounting.

The accounts assume that labor's share of proprietors' income is about 80 percent--the same as its share of the rest of national income.¹

Other taxes and transfers are assigned in a similar way:

- o Property taxes are assigned according to home values reported in the Survey of Income and Program Participation (SIPP) conducted by the Census Bureau;
- o Capital income taxes (with special adjustments described below) according to assets reported in the Survey of Consumer Finances conducted by the Federal Reserve Board;
- o Excise taxes according to household consumption reported in the Consumer Expenditure Survey presented by the Bureau of Labor Statistics;
- o Social Security benefits according to payments reported in the *Social Security Bulletin* published by the Social Security Administration (SSA);
- o Medicare and Medicaid according to health benefits reported in the National Medical Care Expenditure Survey conducted by the National Center for Health Services Research; and
- o All other transfers according to benefits reported in the SIPP.

The accounts do not reflect the nature of the federal tax on personal income. They assume that the tax is paid in proportion to income from capital or labor. But the federal income tax is progressive--that is, people with higher incomes pay tax at higher rates. And incomes are related to age and sex; on average, people who are young or female have lower incomes than those who are middle-aged or male.

The relative-age profiles will change somewhat each time they are updated from the most recent survey or from a new data source. The change may reflect real trends or misleading results of sampling. In particular, the business cycle will affect relative-age profiles. For example, a young worker is more likely to lose a job during a recession; an old stockholder is more likely to suffer a drop in asset value and divi-

dend income. Year-to-year changes in the accounts must be interpreted with those possibilities in mind.

Deciding on the Incidence of Taxes and Transfers

The way that the relative-age profiles are constructed depends on assumptions about the incidence of each type of tax and transfer. The assumptions made in the accounts imply that the supplies of saving and labor do not respond to changes in incentives that taxes and transfers provide.

Incidence is not obvious for two reasons. First, market forces may "shift" a tax or transfer from the legal payer or recipient to others. For example, if workers supply the same amount of labor regardless of pay, employers can shift their share of the payroll tax to workers by reducing wages.¹ That example illustrates a general rule: the less elastically supply responds to price, wage, or interest rate, the more the supplier bears the tax on the good, labor, or capital.

By contrast, higher retirement benefits might induce old workers to leave their jobs. Owners would have to raise the pay of remaining workers and suffer lower profits or pass the cost to consumers (including owners, workers, and retirees) as higher prices. None of that would happen, however, if old workers stayed at their jobs despite the higher retirement benefits (that is, if they supplied labor inelastically). Those who are retired now--or who will retire later--would get higher benefits, and that would be that.

Second, for familial or social reasons, transfers may "slide" from the direct recipient to others. For example, Social Security recipients might need less support from or give larger bequests to their children because of the benefits. If so, at least some of the benefits slide to the children. Any benefits that slide make the children better off and leave the parents as well off as they would have been otherwise. Benefits can slide even when the parties do not know each other. For instance, hospitals may treat uninsured patients and recoup their costs by charging higher

1. Congressional Budget Office, *An Analysis of the Administration's Health Proposal* (February 1994), Chapter 4.

prices to other patients. Those patients would therefore benefit if government provided aid to the uninsured.

The accounts assume that some taxes shift fully, some partially, and some not at all, and that no transfers shift or slide. Business excise taxes and the employer's share of the payroll tax are assumed to shift completely. Consumers and workers are assumed to pay those taxes rather than merchants and employers. Taxes on capital income are assumed to shift partially--that is, owners of capital, financial assets, and homes bear the total tax in the same proportion that they own the total net assets. By contrast, the accounts assume that people pay all of the property taxes on their homes, and workers pay all of the income and payroll taxes on their earnings from labor. And recipients of transfers are assumed to enjoy the full benefits without any effect on anyone else.

The assumptions for shifting and sliding imply that both labor and saving are supplied inelastically. Competition in financial markets ensures that capital, financial assets, and homes earn comparable risk-adjusted rates of return after tax (which is why, in the accounts, their owners bear the tax on income from capital according to their share of total net assets).

Assigning Taxes on Capital Income

The accounts treat taxes on capital income in a complex way because of investment incentives (accelerated depreciation or investment tax credits). The incentives make it necessary to adjust the data from the Current Population Survey in order to assign taxes to the right generations. Those adjustments are required, given the incentives under either current law or a change in law.

Investment Incentives Under Current Law. Investment incentives make owners of existing capital pay higher taxes on their prospective income than owners of new capital--that is, investment (see Appendix B). Hence, existing capital commands a lower price than otherwise-equivalent new capital; the difference in price is the present value of the excess taxes--in other words, the difference in taxes on income from existing and new capital. ("Excess" is

used to describe the effect of tax law, not to suggest that taxes are too high.) Given its discounted price, buyers of existing capital will earn the same income after taxes as if they had bought new capital. Current owners pay the excess taxes whether they hold or sell their capital; they pay in fact if they hold and in effect if they sell. (For that purpose, owners include those who hold financial assets or homes because in the long run competition makes them bear their proportional share of the tax.)

Therefore, some taxes in a later year will in effect be paid by this year's owners who have sold in the meantime, rather than by that later year's owners. The accounts must allow for that event in order to assign prospective taxes to people in the right generations. To do so, they prorate the present value of the excess taxes to this year's owners.

Without the adjustments, the accounts would understate prospective taxes of the middle-aged and old and overstate those of the young. For example, the adjustments add about \$6,000 to the present value of taxes of the average 60-year-old. That amount is about 15 percent of the value of his or her capital.

Investment Incentives Under a Change in Law. If investment incentives are raised, resources are transferred from old to young, according to the accounts. The higher incentives effectively reduce taxes on new capital. But taxes on existing capital remain as they were, so excess taxes are even higher than before. The accounts prorate the present value of the increase in excess taxes to current owners. At the same time, the lower effective tax rate on new capital reduces the taxes that prospective owners will pay. Thus, according to the accounts, an increase in incentives raises taxes of current owners (mostly old) and reduces those of prospective owners (mostly young).

In principle, the effect on a current owner when an investment incentive rises is the same as that on a bondholder when the interest rate rises. If both hold their assets until the assets expire, they will pay as much tax or earn as much interest as they would have in the absence of the rise. But their assets will fall in value because new capital would pay less tax, or a new bond would earn more interest. If they sell, they have to absorb the difference in higher taxes or lower interest.

Assigning Taxes and Transfers Within Families

Arbitrary judgments must be made in order to assign taxes and transfers within families. There is no clearly right way to split net taxes between husbands and wives, or between parents and children. Should a payroll tax be assigned to the earner, to husband and wife jointly, or to all family members according to their share of consumption?

The accounts use a variety of methods to assign taxes within families. They assign payroll and income taxes to husbands and wives according to which earns the pay or owns the asset. By contrast, property taxes are split 50-50. And excise taxes are assigned to all family members according to their share of consumption. So, for example, the accounts estimate that a current newborn pays about one-fifth as much in excise taxes as a 40-year-old.

Transfers are assigned to the person who directly receives a payment or service. Therefore, the accounts assign to the head of a family the benefits from Aid to Families with Dependent Children (AFDC), Food Stamps, and general welfare. And the direct recipient is assigned the benefits from Social Security, Medicare, Medicaid, and unemployment insurance.

Those treatments can lead to anomalies, although the most severe problem can easily be avoided. Any method of splitting net taxes between husbands and wives must be arbitrary and can produce misleading results. It is possible to avoid such problems by presenting the results as weighted averages for males and females together rather than separately. This study does so.

Problems remain in treating dependent children, however. For instance, according to the version of the accounts used for this study, children would benefit from an increase in their Medicaid or Survivors' Insurance benefits, but not from an increase in AFDC benefits. But they should benefit from AFDC; that is its purpose. Similarly, the accounts indicate that children would lose if an increase in excise taxes paid

for higher income tax exemptions for dependents. The net income of their family, however, would rise.

It would seem preferable to choose one consistent method to treat dependent children--that is, to assign the cash value of net taxes either to adults or to all family members according to their share of consumption. Either choice involves arbitrary elements, but consistency would help clarify matters.

Calculating Generational Accounts

In order to estimate the net taxes of future generations, the zero-sum constraint is rearranged. In other words, the present value (PV) of net taxes of future generations must equal the current net debt of government, plus the present value of all prospective government purchases, minus the present value of prospective net taxes of current generations:

$$\text{PV}(\text{Net Taxes of All Future Generations}) =$$

$$\text{Net Government Debt}$$

$$+ \text{PV}(\text{All Prospective Government Purchases})$$

$$- \text{PV}(\text{Prospective Net Taxes of All Current Generations}).$$

Thus, calculating the present value of net taxes of future generations involves estimating the three parts of the right side of the equation. Essentially, the present value of net taxes of future generations defines the "bill" that they would inherit if prevailing policy remained unchanged. Because it is calculated as a residual, that bill will accumulate any errors on the right side of the equation.

Two elements are required to project net taxes of current generations and government purchases: a definition of "prevailing policy," which relates taxes and spending to population and income, and projections of population and income.

Defining Prevailing Policy

The relative-age profiles serve as a key to defining prevailing policy. The assumption that the profiles remain fixed under prevailing policy relates people's prospective taxes and transfers with their age. It then remains to relate taxes and spending with their income.

Net Taxes of Current Generations. Prevailing policy is defined in two parts: first by current policy, then by a mechanical rule. That is, current policy determines the total of each tax and transfer in an official projection of the economy and budget. Given the relative-age profiles and a projection of population, the taxes and transfers of the average member of each current generation are calculated through the end of the projection period.

Beyond the official projection, prevailing policy applies a rule: each year, the real taxes and transfers of the average person of a given age grow at the same rate as productivity (loosely, real output per worker). For instance, suppose a 30-year-old man paid \$4,000 in payroll taxes in a given year and productivity grew at 1 percent a year. The next year, a 30-year-old man (the previous year's 29-year-old) would pay \$4,040 in payroll taxes. That rule keeps relative-age profiles fixed, but allows absolute profiles to grow in line with productivity.

This method enables the accounts to project the net taxes of the average members of all current generations through the rest of their lives. A projection of population determines the number of people of a given generation who will survive in each succeeding year. Therefore, the extensions reflect growth in the economy, and mortality and migration in the population. The entire procedure applies only to current generations because the net taxes of future generations are determined from the zero-sum constraint.

Government Purchases. Government purchases are also determined by an official projection, then by a rule that relates them to the growth of productivity and population. The rule for purchases, however, applies to both current and future generations. In other words, the accounts take all purchases as given

by prevailing policy, then ask which generations pay for them with their net taxes.

Implications of Prevailing Policy. The mechanical rules used to define prevailing policy imply that current law would not remain as it is for current generations. For example, the rules would require that the Congress adjust tax schedules so that overall growth in real incomes did not push people now living into higher income tax brackets. Similarly, the Congress would have to adjust welfare benefits so that the payment for the average person (now alive) at each age grew at the same rate as wages (which grow at the same rate as productivity).

Such rules are commonly used for long-run projections because they make all sectors of the economy grow at the same rate as income and output. For instance, the taxes and transfers of current generations would remain constant as shares of their incomes. And government purchases would remain constant as a share of output (when the age of the population remains stable). If sectors did not grow at the same rate in the long run, the fastest-growing sector would grow to the size of the whole. Therefore, mechanical rules are typically used in the absence of better information.

Nevertheless, sectors can grow faster or slower than output for long periods. For instance, over the past century consumer services have grown from 23 percent of output to 39 percent, and farm products have shrunk from 23 percent of output to 1 percent. Thus, the definition of prevailing policy contains a subjective element.

Choosing Projections of Population and Income

Given the rules of prevailing policy, the accounts need economic and demographic assumptions in order to extend and discount the components of the zero-sum equation. For their base case, the accounts assume:

- o Productivity, as the accounts define it, grows at the rate that the Office of Management and Budget (OMB) projects through 2004, and thereafter

- at 0.75 percent a year (roughly its rate since the mid-1970s);
- o Population follows the Social Security Administration's midgrowth projection through 2080 and a mechanical extension thereafter;
- o The structure of the economy remains as it is today; and
- o A real discount rate of 6 percent applies to all streams of taxes and transfers for all generations.

Productivity. In accord with fixed relative-age profiles, productivity is defined as real output per "effective worker" rather than per actual worker. The definition notes that, say, the average 40-year-old is more productive than the average 60-year-old. Thus, output per actual worker will grow faster than output per effective worker if the number of 40-year-olds grows faster than the number of 60-year-olds, other things being equal. That assumption implies that all income from labor will fall as a share of total income as the population ages.

Population. Population is extrapolated from 2080 to 2200 by assuming that the rates of fertility, death, and immigration remain at the levels the SSA projects for 2080. After 2200, the size and composition of the population are assumed to remain constant. (By about 2040, the SSA projections already put growth of the population near zero.)

Structure of the Economy. Fixed relative-age profiles define the structure of the economy. For instance, they imply that, by age and sex, there is never any change in rates of participation in the labor force, relative earnings, the average work week, the ratios of assets to income, health needs, and so forth.

Discount Rate. The authors of the accounts reason that the real rate of discount should be higher than the real rate of interest on long-term government debt (which is about 2 percent or 3 percent). They maintain that payment of prospective taxes and transfers is less certain than payment of interest and repayment of debt. If so, people should use a discount rate that includes a premium to account for the risk that their net taxes may vary from those scheduled. A real rate of 6 percent equals the average historical rate of re-

turn on equity before tax. A before-tax rate is used because net taxes are drawn from the before-tax income of the nation.

Calculating the Components of the Zero-Sum Constraint

Given specific projections of the economy, it is now possible to calculate the components of the zero-sum constraint, namely:

- o Net government debt,
- o Present value of all prospective government purchases,
- o Present value of prospective net taxes of current generations, and
- o Present value of net taxes of future generations.

Net Government Debt. As an estimate of net government debt, the accounts use the sum of all deficits since 1900 at the federal, state, and local levels. The deficits are those defined by the national income and product accounts (NIPAs). Unlike the unified deficit, the NIPA deficit excludes financial transactions of government, such as loans to the public. Therefore, the sum approximates what government owes to the public, less what the public owes to government.

The sum excludes government debt held by government entities, such as the Social Security trust fund, because issue of that debt does not show up in the unified deficit. Such issue is merely a bookkeeping entry that authorizes the agency to spend money. Moreover, generational accounts omit tangible assets of government--such as land, schools, or highways--that reduce net debt. Omitting such assets is not serious, however, because including them would also require including an offsetting item (see Box 2).

Present Value of All Prospective Government Purchases. Purchases are projected under current policy for 10 years, through 2004 in the version of the accounts that the Congressional Budget Office used. Federal purchases are projected by OMB, and state and local purchases are assumed to grow at the

Box 2.
Tangible Assets of Government

A tangible asset produces services that people consume during its lifetime. For instance, people use the services of public highways when they travel by car, just as they use the services of private rail tracks when they travel by train. In other words, people consume the services of an asset when they use it, not when they buy it. Moreover, the present value of those services (less associated costs) is simply the value of the asset (otherwise it would not be worth its cost).

Ideally, a record of government activity would include consumption of the services of tangible public assets, not just their purchase. But generational accounts treat such assets as if they were consumed the year they were bought. That is, government purchases for any year include the purchase of new public capital, but exclude the services of existing public capital. (The accounts follow the Department of Commerce in this regard.)

That treatment makes little practical difference for the accounts. It would make no difference whether the accounts included the prospective purchase of public assets when they are bought or the consumption of their services when they are used. The present value of prospective government purchases would be the same in either case (because the value of the asset is the present value of its services).

Similarly, if the accounts included tangible government assets as an offset to government debt, they

would have to include the services of those assets in prospective purchases. For instance, if government sold an asset to reduce its debt, it would no longer be able to provide the public services that the asset would produce. Government would have to buy such services in order to provide for the public consumption that is scheduled under prevailing policy. Again, the result would be a wash in terms of present value.

An asset sale by itself would have no effect on the net taxes of any generation because government would simply exchange one asset for another (cash). By contrast, a sale would reduce the unified deficit in that year by the sale price (but would not affect spending caps under the Budget Enforcement Act of 1990).

The discussion above supposes some conditions that may not always be true. The sale or lease of a government asset may not correctly reflect its social value. For example, government receives fees that are generally lower than market values for rights to mine, graze, or cut timber on public lands. Moreover, it is often difficult to assess the social value of public assets, primarily because they serve functions that the private sector does not. (What is the social value of the Liberty Bell or an aircraft carrier?) Moreover, generational accounts would not record unexpected changes in the value of government assets, such as the discovery of oil on public land. Stating those problems, however, does not do much to advance their solutions.

rate OMB projects for gross domestic product. (The latest presentation of the accounts has OMB's numbers for federal taxes and spending through 2030.² The difference does not affect the main results presented later.)

To extend purchases by a mechanical rule, it is assumed that some are related to the age of the population, whereas others are not. More specifically,

about 40 cents of each dollar of purchases depend on the number of people in given age groups (for instance, for education of the young), and about 60 cents depend on total population without regard to age (for instance, for defense). The accounts assume that those fractions apply at the end of the official projection and will remain fixed.

Total purchases are then extended by assuming that real purchases per person in each subpopulation group and in the total population grow at the rate of productivity. The present value of prospective purchases through 2200 can be calculated by applying a discount rate. It is possible to calculate the present value of purchases beyond that date by a simple

2. Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Restoring Generational Balance in U.S. Fiscal Policy: What Will It Take?" *Economic Review*, Federal Reserve Bank of Cleveland, vol. 31, no. 1 (First Quarter 1995), pp. 2-12.

equation because the size and composition of the population are assumed to remain stable after 2200.

Over the past 30 years, this method of projecting government purchases would have overstated their growth. During that period, state and local purchases rose as a share of gross domestic product (GDP) from 9 percent to 11 percent, but federal purchases fell from 11 percent to 7 percent, mostly because of slow growth in defense spending. All government purchases fell from 20 percent of GDP to 18 percent.

Present Value of Prospective Net Taxes of Current Generations. Generational accounts combine official projections under current policy from a number of sources. OMB's projection of taxes and spending through 2004 serves as a base in the version of the accounts that CBO used.³ Current policy can be defined in two ways, however: after 1998, it might hold discretionary federal spending constant in either real or nominal terms. The definition OMB used implies more spending through 2004 and, hence, higher net taxes for future generations.

Other official sources are used to extend the totals of some taxes and transfers beyond 2004. Through 2030, the accounts use projections by the Health Care Financing Administration (HCFA) for Medicare and Medicaid; through 2070, the accounts use projections by the SSA for payroll taxes and Social Security benefits. Those agencies provide modifications of their official projections that are consistent with the economic assumptions of the accounts. The accounts then make the yearly total for each tax or transfer grow from 2004 to the end of its official horizon at the same rate as it does in its modified projection.

Beyond the official horizons, prevailing policy assumes that the real taxes and transfers of the average person of a given age grow at the rate of productivity. Thus, projections of most taxes and transfers reflect rules that keep their growth in line with incomes after 2004.

But the largest and fastest-growing transfers reflect current law and official projections through 2030 or 2070. For instance, prevailing policy includes the assumption by HCFA that real medical costs per recipient will grow faster than productivity through 2020 and the phase-in of the earliest age--from 65 to 67--at which Social Security recipients may draw full benefits.

This method yields the prospective net taxes of the average members of each current generation for the rest of their lives. The accounts apply a discount rate to those net tax streams to calculate their present values. Adding those present values for all the people of every age now alive gives the present value of net taxes of all current generations.

Present Value of Net Taxes of Future Generations. The present value of net taxes of all future generations is now given from the right-side components of the zero-sum equation. To find the payments of each future generation, it is assumed that they all pay net taxes at the same rate. Then it is possible to calculate their payments knowing the number of people in each generation and their income. The number of people is given by the population projection, and their income by the growth of productivity. For example, the real income of next year's average newborn will be higher than that of this year's by the growth of productivity, and so on. Arithmetic then gives the present value of net taxes of each future generation. That calculation is not intended to be realistic, but to make it possible to speak of a representative future generation.

Reporting and Interpreting Generational Accounts

Generational accounts must report the results in a way that provides a basis of comparison among generations. Simply reporting the results as the present values of prospective net taxes under a given policy would not do so. For example, under prevailing policy, the present value of prospective net taxes of a 40-year-old is higher than that of a 50-year-old. The

3. *Budget of the United States Government, Fiscal Year 1995* (January 1994).

40-year-old has 10 more years of taxes to pay and is 10 years further from receiving Social Security and Medicare.

It is not possible to know from that comparison, however, whether past and prospective policy treat the two in the same way. For example, the 40-year-old has earned higher real income than the 50-year-old did at comparable ages. Furthermore, has the 40-year-old paid net taxes in the past at the same rates that the 50-year-old had at the age of 40? Will the 40-year-old pay net taxes for the next 10 years at the same rates that the 50-year-old did for the past 10 years?

Reporting the Results

Generational accounts can be reported in at least two ways that provide a basis of comparison among all generations: as a net tax rate paid over a lifetime or as a change in the present value of prospective net taxes under a change in policy.

Lifetime Net Tax Rate. A generation's lifetime net tax rate is its lifetime net taxes as a percentage of its lifetime labor income. Specifically, a lifetime net taxrate is the present value at birth of net taxes over a lifetime as a percentage of the present value at birth of labor income over a lifetime. (Lifetime labor income is used as a base because it is closely related to lifetime consumption--a basic measure of well-being. See Box 3.) This calculation compares all generations on the same basis because it includes the effects of all policy, past and prospective, from birth.

To calculate lifetime net tax rates, the accounts must first estimate net taxes already paid by the average member of each current generation. To do so, the accounts use survey data to estimate the relative-age profiles for labor income, taxes, and transfers that prevailed in the past.

The survey data go back only as far as 1964, so the accounts assume that the relative-age profiles for 1964 were valid from 1900 to 1964. (That assumption is clearly heroic. For instance, females were

Box 3. Lifetime Labor Income and Lifetime Consumption

If it was not for gifts and bequests, generational accounts would accurately represent the present value at birth of lifetime consumption. With no gifts or bequests, people would consume all of their lifetime income, and all income from capital would be the return from previously saved income from labor. But the present value of the return from capital is simply the original amount saved (not consumed). Thus, the present value at birth of lifetime consumption would equal the present value at birth of lifetime income from labor--the measure that the accounts use.

But gifts and bequests upset the equality. Income from inherited capital does not represent a return on saving from an heir's past income from labor. And gifts and bequests are important to the distribution of wealth. One study estimates that about 80 percent of existing capital has been received as a gift or bequest and only 20 percent saved from the owner's income from labor. Estimates from another study, however, reverse those figures. The most recent study estimates that at least 20 percent of wealth represents past

gifts and that at least 50 percent represents either gifts or bequests.¹

The approximation in the accounts, however, remains fair. Income from labor amounts to about four-fifths of total net income. Moreover, inheritances usually occur so late in life that their present value at birth remains small in relation to that of income from labor. The error in the approximation would differ among generations if they received bequests of different amounts (in relation to their income from labor) or at different ages.

1. See Laurence J. Kotlikoff and Lawrence H. Summers, "The Role of Intergenerational Transfers in Aggregate Capital Accumulation," *Journal of Political Economy*, vol. 89, no. 4 (August 1981), pp. 706-732; Franco Modigliani, "The Role of Intergenerational Transfers and Life Cycle Saving in the Accumulation of Wealth," *Journal of Economic Perspectives*, vol. 2, no. 2 (Spring 1988), pp. 15-40; and William G. Gale and John Karl Scholz, "Intergenerational Transfers and the Accumulation of Wealth," *Journal of Economic Perspectives*, vol. 8, no. 4 (Fall 1994), pp. 145-160.

about twice as likely to work for pay in 1964 as they were at the turn of the century.) The accounts then use historical data to estimate how much the average member of each generation earned in income from labor, paid in taxes, and received in transfers each year in the past. Past net taxes and income from labor, together with prospective net taxes and income from labor, yield lifetime net taxes and income from labor. Those lifetime streams for each generation are discounted to find their present value, then divided to find their lifetime net tax rate.

Dollar Change in Present Value of Net Taxes. The results may also be presented as the change in the present value of net taxes for any given change in policy. For instance, a new policy might reduce the present value of net taxes of the average 20-year-old by \$200 and raise that of the average 50-year-old by \$100. This presentation also compares people of all ages on the same basis because the entire effect of the change in policy is prospective. But the results must be interpreted with care because they do not reflect the net taxes that people of different ages have paid or will pay.

Interpreting the Results

Generational accounts serve only as an abstract indicator, not a predictor or goal. They do not say how policy will or should evolve; such questions remain beyond analysis.

The accounts set a standard by which prevailing policy may be judged and other policies compared. In that respect, they resemble other conceptual standards that answer "as if" questions, rather than making realistic predictions. For example, the baseline budget establishes a reference point as if current policy were to remain in force for everyone, alive or yet to be born; or the full-employment budget separates the effects of policy on the budget from the effects of the economy on the budget as if the economy were at full employment. Generational accounts indicate how policy would distribute resources among generations as if prevailing policy were to continue without change for those now living.

As one point of reference, the accounts indicate whether a policy is "sustainable." It is if scheduled rates of taxes and spending according to age need not change to satisfy the zero-sum constraint. Thus, a policy is sustainable if it implies no difference in the lifetime net tax rates of future generations and current newborns. In that case, each generation could pay net taxes at every age at the rates that are scheduled now and satisfy the zero-sum constraint. Of course, those rates must also be feasible; for instance, people cannot pay more in net taxes than they earn in a lifetime.

A policy is not sustainable if there is a difference in the lifetime net tax rates of future generations and current newborns. In that case, scheduled rates of taxes or spending according to age would have to change--for either current or future generations--in order to satisfy the zero-sum constraint. The accounts do not predict how taxes or spending would change.

Sustainability need not imply desirability. For example, future generations will typically be much richer than current generations, so it may be fair for them to pay net taxes at higher rates. The accounts can address only sustainability, not fairness.

Generational accounts and long-term deficit projections both address sustainability, but present the information in different ways. Strictly, the accounts and an infinite projection of the deficit would require the same data and assumptions. (The information they convey would be equivalent if the accounts used a discount rate equal to the interest rate on government debt.) Given an infinite horizon, implicit obligations must show up in the deficit at some time. In that case, it is not possible to obscure the direction of policy by undertaking implicit obligations that do not raise the deficit now, but would raise it later. Thus, a deficit projection would show that policy is not sustainable if government debt would continually rise in relation to output.

A deficit projection would not, however, address distribution by age. Therefore, some advocates of generational accounts maintain that debate about fiscal policy should focus on how it affects those accounts, rather than the deficit (see Appendix C).

Findings of Generational Accounts

Given the base assumptions of generational accounts, three findings stand out. First, prevailing policy is not sustainable. It implies that future generations would have to pay lifetime net taxes at about twice the rate of current newborns (assuming that all current generations pay net taxes at prevailing rates for the rest of their lives). Second, reaching a sustainable policy would require a change in policy equivalent in present value to spending cuts and tax increases of about 8 percent across the board. Third, the deficit does not necessarily indicate the way in which fiscal policy is distributing resources among generations. The accounts indicate that fiscal policy since World War II had different generational effects than the deficit would seem to suggest. The accounts and the deficit may also give different signals about prospective policies.

In analyzing these findings, the Congressional Budget Office used a computer program and data provided by the authors of the accounts. CBO cannot vouch for the data or program. There is no reason to believe that they contain errors, although errors have appeared in past versions (a common occurrence when developing a complex system).

Assessing the Evolution and Status of Generational Policy

According to the accounts, lifetime net tax rates of succeeding generations have risen steadily over this

century. The rates rose from 24 percent for people born in 1900 to 37 percent for those born in 1990 (see Table 1). Those figures combine net taxes at all levels of government--federal, state, and local (see Box 4 on page 21).

The lifetime net tax rate of future generations would have to rise to nearly 80 percent to settle the bill. That represents about twice the lifetime net tax rate of current newborns, or a difference in lifetime net tax rates of future generations and current newborns of more than 40 percentage points.

The bill for the future would be even higher if not for the Omnibus Budget Reconciliation Act of 1993 (OBRA-93). The version of the accounts that this study used predates OBRA-93. But an updated version that includes the provisions of OBRA-93 also includes new economic and technical assumptions that offset the effects of those provisions. As a result, using the updated version would not appreciably change any numbers reported here (see Box 5 on page 22).

Rapidly rising medical costs and aging of the population account for most of the difference in lifetime net tax rates of future generations and current newborns. Rising costs of medical services per recipient account for most of the rise in health spending; a rising number of Medicare recipients accounts for a much smaller part. The aging of the population means that baby boomers are scheduled to receive more in Social Security benefits when they retire than prevailing tax rates will provide.

Why Do Lifetime Net Tax Rates Seem So High?

The lifetime net tax rates shown in Table 1 may seem high when compared with the more familiar "current net tax rates" (current net taxes as a percentage of

Table 1.
Estimated Lifetime Tax and Transfer Rates by Year of Birth (Average for males and females, in percent)

Year of Birth	Net Tax Rate ^a	Gross Tax Rate	Transfer Rate
1900	24	28	3
1910	28	33	6
1920	29	36	7
1930	31	39	8
1940	32	41	9
1950	34	44	10
1960	35	46	11
1970	36	50	12
1980	37	51	13
1990	37	51	13
Future Generations	78	b	b

SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: The rates shown are for taxes and transfers at all levels of government combined—federal, state, and local.

The estimates assume a real discount rate of 6 percent, a prospective annual rate of growth in productivity of 0.75 percent, and the midgrowth path of population used by the Social Security Administration in its 1993 annual report.

The values in the table reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

a. A lifetime net tax rate is the present value at birth of lifetime net taxes as a percentage of the present value at birth of lifetime labor income. The net tax rate equals the gross tax rate less the transfer rate (except for possible differences because of rounding).

b. There are no unique values of gross tax and transfer rates for future generations. For the base case shown, any combination of lifetime tax and transfer rates that nets to 78 percent is feasible, at least arithmetically.

current market income). For example, the lifetime net tax rate of current newborns is 37 percent, whereas net taxes of the nation now stand at only 24 percent of national income.

But current net tax rates do not directly compare all generations on the same basis because such rates vary widely with age. The young and middle-aged typically earn most of market income and pay most of total taxes. And the old typically receive more in transfers than they pay in taxes.

Given that pattern, three factors explain why estimated lifetime net tax rates are as high as they are. First, present value gives more weight to taxes paid earlier than to transfers received later. Second, people do not all live to old age. Therefore, the accounts give more weight to prospective taxes than to prospective transfers because people are more likely to pay the taxes than receive the transfers. Finally, lifetime net tax rates are based on labor income rather than total income, which current net tax rates are based on. Using the smaller measure as a base leads to a higher lifetime net tax rate. For comparison, current net taxes are 30 percent of labor income, whereas they are only 24 percent of total income.

What Do the Lifetime Net Tax Rates of Various Generations Imply?

Rising lifetime net tax rates did not necessarily make successive generations worse off than their predecessors. First, most of the increase has paid for a similar rise in the rate of government purchases during the period from 1900 to about 1950. But the accounts do not assign the benefits of purchases to specific generations. Second, estimated lifetime incomes rose significantly during this century (aside from any benefits from government purchases). The accounts estimate that the lifetime income, after taxes and inflation, of the average person born in 1990 is about three times that of the average person born in 1900.

Pervading policy, however, implies that the lifetime after-tax income of at least some future generations would fall below that of current newborns (given the base assumptions of the accounts). That would happen if, as the accounts assume, all future

Box 4.
The Case in Favor of Separate Generational Accounts

It would be useful to present generational accounts for the federal sector separately because combined accounts for all levels of government mask the source of generational policy. (The combined accounts, however, can isolate the effects of changes in, rather than levels of, federal activity.)

For example, suppose that projected purchases by local governments reflect the need for relatively less spending on education. Thus, if local governments maintain budgets in approximate balance, they could reduce the rate of property taxes, which largely finance education. Even if local authorities kept the same property tax rate, as the accounts assume, it would not correct fiscal imbalance at the federal level. Instead, it would maintain the amount of property taxes deducted from the federal tax base.

Combining the accounts also mixes apples and oranges. Typical federal activities usually have different implications for given age groups than typical nonfederal activities. For example, about half of federal excise taxes come from gasoline, tobacco, and alcohol. Taxes on those items tend to apply more narrowly to specific age groups than the more broadly based excise taxes of states and localities. And most of the purchases that state and local governments make are related to the age of the people, such as those for education, whereas most of the federal government's are unrelated to age, such as those for defense. Finally, particular taxes of state and local governments are more often tied to particular purchases—for example, property taxes and purchases to provide municipal services. Separating the accounts, therefore, would alleviate some problems of interpretation.

generations pay lifetime net taxes at twice the rate of current newborns. But it would also happen no matter how future generations might settle the bill.

For example, it may seem arithmetically feasible for future generations to settle the bill by having incredibly rich generations far in the future pay net taxes at a lifetime rate of nearly 100 percent. If their before-tax incomes were high enough, they would be left with at least as much after-tax income as current newborns. (Of course, this hypothetical scheme ignores the adverse effects of high taxes on economic activity.) But prevailing policy would leave too large a bill for future generations to make the scheme feasible, even arithmetically.¹ Therefore, under the base assumptions of the accounts, prevailing policy would make at least some future generations worse off than current newborns.

Eliminating the Difference in Lifetime Net Tax Rates of Future Generations and Current Newborns

What policy would equalize the lifetime net tax rates of current newborns and future generations? An infinite number of policies could do so. One way to pose the problem in an easily handled form is to ask the hypothetical question: how much would a tax have to be raised or a transfer reduced now if its total grew thereafter at its previously projected rate?

Such an abstract approach does not consider realistic options; it merely defines the size of the problem for further analysis and debate. The approach does not address many issues that the Congress would have to consider: the short- and long-term effect on the economy, distribution by income, and so forth. In fact, the Congress may decide to reduce lifetime net tax rates of future generations, but not to the same rate as that of current newborns. In any

1. According to the accounts, the scheme would be arithmetically feasible in some instances with a low rate of discount and high rates of growth of productivity and population.

Box 5.
Would an Updated Version of Generational Accounts Change the Results?

The results reported in this study would not change significantly if the Congressional Budget Office had used an updated version of generational accounts. The version used reflects the 10-year economic and budget projections of the Office of Management and Budget's (OMB's) 1992 midyear update, which do not include the provisions of the Omnibus Budget Reconciliation Act of 1993 (OBRA-93). The latest official version reflects the 10-year projections of OMB's 1993 midyear update, which include the provisions of OBRA-93, plus a new method of projecting the Medicaid expenditures of state and local governments, and updated relative-age profiles for taxes and transfers.

The results of those changes nearly cancel each other. Without OBRA-93, the changes would have raised the lifetime net tax rates of future generations from 78 percent to 94 percent, while barely changing those of current generations (see table below). About half of this difference arises because the new version of the accounts assumes that Medicaid spending by state and local governments will grow through 2004 at the same rate that the Health Care Financing Administration projects total Medicaid expenditures to grow rather than at the same rate as gross domestic product. The rest of the difference comes from updated economic

projections and relative-age profiles for taxes and transfers--and, to a small extent, because the new generation of current newborns has moved from being part of future generations to being part of current generations.

Alternatively, OMB estimated that OBRA-93 would directly reduce the deficit from 1994 through 1998 by \$429 billion by means of a combination of higher taxes, lower spending for mandatory programs, and new caps on discretionary spending from 1996 through 1998. Given the 1993 economic projections, those provisions lowered the lifetime net tax rates of future generations to 82 percent, but again barely changed those of current generations. The net result of the two effects is essentially a wash, and there is no reason to believe that using the latest version would significantly change any results reported in this study, either qualitatively or quantitatively.

The budget resolution of 1995 would substantially change the results that are shown in the table. But the decisions necessary to carry out the resolution have not been made. Therefore, it would be premature to speculate about how the generational accounts for people of different ages would change.

**Estimated Lifetime Net Tax Rates Before and After the Omnibus Budget Reconciliation Act of 1993
(Average for males and females, in percent)**

Year of Birth	Before OBRA-93 (1992 Version)	Before OBRA-93 (1993 Version)	After OBRA-93 (1994 Version)
1900	24	24	24
1910	27	27	27
1920	29	29	29
1930	31	31	31
1940	32	32	32
1950	34	33	33
1960	35	34	35
1970	36	36	37
1980	37	36	37
1990	37	36	37
Future Generations	78	94	82

SOURCE: Congressional Budget Office, using data and a computer program provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110; and Office of Management and Budget, *Budget of the United States Government, Fiscal Year 1995: Analytical Perspectives* (January 1994), p. 25.

NOTES: A lifetime net tax rate is the present value at birth of lifetime net taxes as a percentage of the present value at birth of lifetime labor income. The rates shown are for net taxes at all levels of government combined--federal, state, and local. The estimates assume a real discount rate of 6 percent, a prospective annual rate of growth in productivity of 0.75 percent, and the mid-growth path of population used by the Social Security Administration in its 1993 annual report. Compared with the 1992 version of generational accounts, the 1993 version projects Medicaid spending by state and local governments differently and contains updated profiles of taxes and transfers by age. The values in the table reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

case, the Congress would not cut only one type of spending or raise only one tax, and would almost certainly make spending or taxes grow at different rates than would prevailing policy. But the approach is realistic in one sense: it identifies sustainable policies in common terms.

The budget item that is changed determines both the size of the change that is needed and the way its costs are spread by age (see Table 2). The size of the hypothetical deficit reduction could vary from \$109 billion for cuts in Social Security benefits to \$227 billion for cuts in government purchases. Those fig-

Table 2.
Distribution of Costs of Hypothetical Policy Changes Needed in 1991 to Reach a Sustainable Policy

Age in 1991	Alternative Proportionate Tax Increases			Alternative Proportionate Spending Cuts			
	Payroll or Labor Income	Excise	Capital Income	Medicare and Medicaid	Social Security	Other Transfers ^a	Government Purchases ^b
Change in Present Value of Net Taxes (In thousands of 1991 dollars)^c							
90	0	1	0	3	3	n.a.	0
80	0	4	6	24	30	n.a.	0
70	0	7	13	33	45	n.a.	0
60	4	11	21	33	44	n.a.	0
50	13	14	26	18	17	n.a.	0
40	21	18	26	18	17	n.a.	0
30	25	19	21	13	11	n.a.	0
20	24	20	15	11	7	n.a.	0
10	15	17	9	8	6	n.a.	0
Newborns	9	12	6	6	4	n.a.	0
Future Generations ^d	-55	-52	-59	-59	-61	n.a.	-64
Corresponding Budget Change in 1991 (In billions of 1991 dollars)							
n.a.	197	210	182	-112	-109	n.a.	-227

SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: The estimates assume a real discount rate of 6 percent, a prospective annual rate of growth in productivity of 0.75 percent, and the midgrowth path of population used by the Social Security Administration in its 1993 annual report.

The values in the table reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

A feasible policy is sustainable if lifetime net tax rates of future generations and current newborns are equal.

n.a. = not applicable.

- a. There are no entries for a cut in other transfers because the required cut would be about twice their total.
- b. A proportionate cut in prospective government purchases affects the net taxes of future, but not current, generations. Both receive fewer services from government purchases. Current generations continue to pay as much as if there had been no cut, so future generations can pay less than they would otherwise.
- c. Average for males and females.
- d. The figures for future generations apply to those born next year. The respective figures for successive future generations would grow at the rate of productivity.

ures represent 38 percent and 18 percent of the respective totals. For perspective, the results shown in Table 2 imply that federal spending cuts and tax increases of about 8 percent across the board would achieve a sustainable policy. That translates to about \$175 billion in 1991. By coincidence, that hypothetical figure is about the size of the federal deficit in that year. But simply eliminating the deficit would not do the job if it did not deal with the long-run problems of an aging population and rapidly growing medical costs.

Two main factors account for the wide variation in the size of the hypothetical deficit cut that is needed: the rate at which the budget item grows and the number of people that the deficit cut affects.

How Fast Does the Budget Item Grow?

A smaller deficit cut is needed when the tax or spending is projected to grow faster. To see why, consider what happens when a shrinking item in the budget gets cut by the same proportion every year. Suppose spending is going to be \$100 this year and \$90 next year. It would take a proportionate cut of 10 percent--\$10 this year and \$9 next year--to save a total of \$19. By contrast, consider a growing program. Suppose spending is going to be \$100 this year and \$110 next year. Then a proportionate cut of only 9 percent would be necessary--\$9 this year and \$10 next year--to save a total of \$19. Cutting a growing spending program gives a bigger bang for the buck. The faster the item grows, the smaller the proportionate change needed to save a given total.

The effect is most pronounced in cuts to health benefits and Social Security. Those programs are projected to grow much faster than other federal spending. Medical costs per recipient are assumed to grow faster than output per capita through 2030 in the version of the accounts that CBO used. Hence, a relatively small proportionate cut in health spending is required to reach a sustainable path. Similarly, retirees are expected to grow as a share of the population; thus, a relatively small proportionate cut in Social Security benefits is necessary to reach a sustainable path. By contrast, a big cut in purchases is necessary to achieve sustainability, mostly because defense purchases are assumed to grow slowly.

How Many People Does the Deficit Cut Affect?

The size of the deficit cut that is needed also depends on the number of people now alive who will pay for the cut with higher net taxes. For instance, the old contribute little to taxes on labor income, but a lot to taxes on capital income. As a result, taxes on labor income would have to rise more than taxes on capital income to achieve sustainability. Similarly, everyone now alive would contribute at some time if benefits for Social Security or Medicare fell. Thus, those actions need a relatively small proportionate deficit cut.

Excise taxes may have to rise by so much, according to the accounts, simply because the accounts assign excise taxes to children. But a newborn next year belongs to a future generation and will not contribute to net taxes of current generations. By contrast, the average 15-year-old does not contribute to payroll taxes this year, but will next year. Thus, there are more current generations in the pipeline to pay tax at higher rates on payroll than on sales.

To some extent, the size of the deficit cut that is needed also depends on how it affects the lifetime net tax rate of current newborns. The more the cut raises their lifetime net tax rate, the less that of future generations has to fall to become equal. That effect is most pronounced in the case of a cut in government purchases because such a cut does not raise the net taxes of current newborns at all.

Assessing Past or Prospective Fiscal Policy

Both retrospective and prospective analyses show that fiscal policy can head in a different direction than the deficit seems to indicate. Looking back, most analysts agree that policies since World War II shifted resources from the young to the old. The accounts, however, put most of the blame on the policies of the 1950s, 1960s, and 1970s rather than the high-deficit years of the 1980s. Looking ahead, the accounts show that the way that fiscal policy shifts

resources among generations can be unrelated to the deficit.

Assessing Fiscal Policy Since World War II

Generational accounts suggest that the direction of postwar fiscal policy was quite different from what is commonly supposed. According to an early version of the accounts, policy through the 1970s made the old better off at the expense of then-young-and-future generations, although deficits were low and debt was falling in relation to output.² Perhaps more surprising, policy in the 1980s had little effect on the net taxes of future generations, although deficits were high and debt was rising in relation to output.

Two main factors account for the gains of the elderly from the 1950s through the 1970s. First, benefits for Social Security and Medicare were increased in each of those decades. Second, payroll taxes rose to help pay for the higher benefits, while taxes on capital income fell as a share of all taxes. The benefit increases helped the old more than the young; the switch in tax bases helped the old and hurt the young; and the mounting bill hurt future generations.

That pattern changed in the 1980s. The Social Security Amendments of 1983 raised payroll taxes and reduced prospective benefits. The law phased in an increase in the earliest age (from 65 to 67) at which retirees could draw full benefits. The law also set a cap on the benefits that people could receive in any year before they were subject to income tax. Because the cap is set in nominal terms, inflation will expose a growing portion of benefits to tax.

The amendments had different effects on different generations. Net taxes changed little for those who were retired or about to retire, but increased for the young and middle-aged. Moreover, the amendments lowered the net taxes required of future generations by raising those of current generations. According to the accounts, that change approximately

offset the effects of higher deficits in the 1980s on the net taxes of future generations.

Those results, however, do not establish that policymakers would have made different choices if they had used generational accounts at the time. First, the accounts assign only the cash cost of net taxes, not the benefits of government purchases. If the accounts could assign those benefits, the pattern of distribution might look different. Purchases, especially for defense, were raised in the 1950s. The benefits to the young of more national security could have been enough to offset the prospect of higher payroll taxes.

Second, the exercise used 20/20 hindsight about the growth of output and population. But analysts in the 1950s and 1960s did not have 20/20 foresight and made inaccurate economic and demographic projections. Analysts at the time assumed that medical costs would rise more slowly than they actually did, that the death rate would fall more slowly, and that productivity would grow more rapidly. Those errors would also have appeared in generational accounts if they had been prepared then.

In a sense, from the 1950s through the 1970s, the nation won one gamble but lost another. During that period, the interest rate on government debt was lower than the growth rate of the economy. That made it possible to win a gamble that the ratio of debt to output would fall without having to raise taxes to pay interest on the debt. But the country lost the gamble that such conditions would persist; government undertook implicit obligations for Social Security and Medicare that it cannot meet as they are currently scheduled.

Assessing Prospective Policy Changes

As an experiment, CBO used the accounts to analyze some hypothetical policy changes. In some ways the results are what the deficit would indicate: for example, a deficit increase would worsen the lot of future generations. The accounts, however, also show that changes in policy can shift resources among generations without changing the deficit at all. Similarly, different ways of changing the deficit by a given

2. See Laurence J. Kotlikoff, *Generational Accounting: Knowing Who Pays, and When, for What We Spend* (New York: The Free Press, 1992), pp. 165-191.

amount can have very different effects on any given generation.

A Policy That Increases the Deficit. The Congressional Budget Office considered a policy that would cut the income tax by 20 percent for five years without changing spending. That would raise the bill left for the future. The hypothetical policy would then raise the income tax by enough to make the bill grow at the same rate that it would have if the tax had not been cut.

Such a policy would benefit the middle-aged and old at the expense of young and future generations (see Table 3). Those about 50 years old would gain the most. Those older than 50 would not gain as much because their labor income has already peaked.

And those younger than 50 would not gain as much because, after five years, they would have to pay higher net taxes for the rest of their lives. In fact, those younger than 30 would pay more under the policy. They would gain little or nothing from the tax cut, but would pay higher net taxes for most of their lives. Furthermore, future generations would lose because the higher bill would require higher net taxes to pay the extra interest. The policy would raise the present value of net taxes of current newborns and future generations by about the same amount.

Three Deficit-Neutral Policies. CBO also considered three policies that would change the mix of taxes and transfers without changing the deficit. The policies qualitatively resemble changes in mix that have occurred slowly since World War II.

Table 3.
Alternative Policies That Would Change the Timing or Mix of Taxes and Transfers
(Change in present value of net taxes, in thousands of 1991 dollars)

Age in 1991	Policy That Would Raise the Deficit Five-Year, 20 Percent Income Tax Cut	Policies That Would Not Change the Deficit		
		20 Percent Increase in Social Security Benefits and Equal-Revenue Rise in Payroll Taxes	30 Percent Increase in Payroll Taxes and Equal-Revenue Cut in Excise Taxes	30 Percent Increase in Payroll Taxes and Equal-Revenue Cut in Income Taxes
90	-0.1	-1.1	-0.4	0
80	-0.8	-9.5	-2.8	-1.0
70	-1.3	-14.4	-4.8	-2.1
60	-2.2	-12.8	-4.8	-2.8
50	-2.3	-4.9	-0.9	-2.2
40	-1.4	0.7	3.3	-0.9
30	0	3.9	5.2	0.7
20	1.3	5.1	3.3	1.6
10	1.7	3.4	-0.9	1.1
Newborn	1.0	2.4	-2.3	0.8
Future Generations ^a	1.0	2.9	-2.1	0.8

SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: The estimates assume a real discount rate of 6 percent, a prospective annual rate of growth in productivity of 0.75 percent, and the midgrowth path of population used by the Social Security Administration in its 1993 annual report.

The values in the tables reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

a. The figures for future generations apply to those born next year. The respective figures for successive future generations would grow at the rate of productivity.

The first policy would increase Social Security benefits by 20 percent and raise the payroll tax to pay for them. This policy would typically cause greater changes on the basis of age than would the temporary tax cut, even though the policy would not change the deficit. For example, the accounts estimate that the present value of net taxes of 60-year-olds would fall by about six times as much as under the temporary tax cut.

The lifetime net taxes of future generations would rise by about three times as much as they would under the temporary tax cut. The extra taxes needed to make extra payments would pass from generation to generation. Those who are now young would pay their extra taxes to those now old, leaving the deficit unaffected. But when those who are now young became old, future generations--those not yet born--would have to pay the extra taxes.

The second policy would raise payroll taxes by 30 percent to pay for a cut in excise (or consumption)

taxes. That policy would cost 20- to 40-year-olds the most. Unlike the other policies, it would reduce the net taxes of the very young because the accounts assign excise taxes according to share of family consumption. The policy would also reduce the net taxes of future generations; there are more middle-aged people to pay higher payroll taxes than old people to pay lower excise taxes.

The third policy would raise payroll taxes by 30 percent to pay for a cut in income taxes. The switch in taxes would benefit the old because more of their prospective income comes from capital than from labor. But the policy would make smaller changes by age than would the other deficit-neutral policies because about 80 percent of national income comes from labor. The source is the same as the payroll tax, so the switch in taxes would mainly shuffle the legal base of the tax. That switch would raise net taxes of future generations because it would reduce net taxes of the old and middle-aged more than it would raise those of the young.

Table 4.
Alternative Policies That Would Cut the Deficit by an Equal Amount
(Change in present value of net taxes, in thousands of 1991 dollars)

Age in 1991	10 Percent Cut in Social Security Benefits	Increase in Capital Income Taxes	Increase in Payroll Taxes	Increase in Excise Taxes
90	0.5	0	0	0.1
80	4.7	1.0	0	0.5
70	7.3	2.0	0.1	1.0
60	7.0	3.3	0.6	1.5
50	4.4	4.1	1.9	2.2
40	2.7	4.0	3.1	2.6
30	1.8	3.3	3.7	2.8
20	1.2	2.4	3.7	3.1
10	0.9	1.6	2.6	2.7
Newborn	0.6	1.0	1.8	2.1
Future Generations ^a	-9.8	-9.4	-8.4	-8.0

SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: The estimates assume a real discount rate of 6 percent, a prospective annual rate of growth in productivity of 0.75 percent, and the midgrowth path of population used by the Social Security Administration in its 1993 annual report.

The values in the tables reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

a. The figures for future generations apply to those born next year. The respective figures for successive future generations would grow at the rate of productivity.

Policies That Reduce the Deficit. Finally, CBO also examined four policies that would cut the deficit by a given amount (about \$29 billion in the first year). The first policy would permanently cut Social Security benefits by 10 percent; the others would raise capital income, payroll, or excise taxes to lower the deficit by the same amount as the cut in benefits.

Those policies would have different effects on people who are now alive, even though they would have the same effect on the deficit (see Table 4). The cuts in benefits would cost those who are about 60 or 70 years old the most because they are at or near the end of their working lives and have most of their retirement ahead. (A phased-in reduction could spread the costs more evenly.) The tax increases, however, would cost those who are about 20 or 30 years old the most. They are still far from retirement and will pay taxes for many years.

The policies would have slightly different effects on future generations even though they would cut the deficit by the same amount. That result occurs because the policies would change the timing of taxes and transfers that pass from generation to generation. For example, cuts in Social Security benefits and increases in capital income taxes fall more heavily on the old, so those policies would eventually make all living generations pay more toward the bill than would raising payroll or excise taxes.

Such exercises show how little information the deficit gives about the effects of policy on different generations. Generational accounts keep track of such effects, some of which may not be apparent without the tools that the accounts provide. The next question is, how accurate and reliable are the accounts?

Uncertainties in Generational Accounts

How much do the fundamental findings of generational accounts depend on the assumptions that go into them? To find out, the Congressional Budget Office used "sensitivity analysis"--that is, it calculated the accounts under a range of assumptions. Quantitatively, the results can depend heavily on such assumptions; qualitatively, however, the conclusion remains that prevailing policy is not sustainable.

Sensitivity of Results to Economic and Demographic Assumptions

CBO chose three alternatives for each of the main assumptions about the population and economy. For population growth, the Social Security Administration's low-, mid-, and high-growth projections were used.¹ For productivity and the discount rate, the alternatives span a range that is typically used for generational accounts.² In each case, the middle of the range represents the base assumption of the accounts.

1. Social Security Administration, *The Annual Report of the Old-Age and Survivors' Insurance and Disability Insurance Trust Fund* (1993).

2. See Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Restoring Generational Balance in U.S. Fiscal Policy: What Will It Take?" *Economic Review*, Federal Reserve Bank of Cleveland, vol. 31, no. 1 (First Quarter 1995), pp. 2-12.

Choosing Alternative Assumptions

The population paths incorporate rates of fertility, death, and net migration that are lowest on the low-growth path and highest on the high-growth path. Therefore, for example, on the low-growth path, low rates of fertility and immigration keep the growth of the workforce low, but low death rates keep the growth of the aged population high. As a result, the fraction of the population that is 65 years old or older increases from about 13 percent today to about 31 percent by 2080 for the low-growth path, 24 percent for the mid-growth path, and 18 percent for the high-growth path.

CBO considered three rates of growth in productivity: 0.25 percent, 0.75 percent, and 1.25 percent. The average rate since the oil shock of 1973 has been about 0.75 percent; since World War II, about 1.5 percent; and since 1900, about 1.25 percent.

Real discount rates of 3 percent, 6 percent, and 9 percent were used. Those roughly match average historical rates of return (before tax) on long-term federal debt, equity, and private capital, respectively.

Sensitivity of Lifetime Net Tax Rates

Estimates of lifetime net tax rates vary widely, depending on assumptions (see Table 5).³ Despite the variation, however, one conclusion stands firm: pre-

3. This study adjusted the alternative results to make them comparable to the base results (see Appendix D).

vailing policy is not sustainable--net tax rates must rise at some time (or rates of purchases must fall) to keep government solvent. If current generations do not contribute more, future generations must. Indeed, the accounts suggest that in some cases prevailing policy is not feasible because it would leave a bill

for future generations that would be beyond their means; that is, the bill would require that they pay lifetime net taxes at a rate of more than 100 percent.

Under the range of assumptions that CBO considered, the lifetime net tax rate of the average mem-

Table 5.
Lifetime Net Tax Rates Under Alternative Economic and Demographic Assumptions (In percent)

Population ^a	Real Discount Rate of 3 Percent			Real Discount Rate of 6 Percent			Real Discount Rate of 9 Percent		
	PGR of 0.25 Percent	PGR of 0.75 Percent	PGR of 1.25 Percent	PGR of 0.25 Percent	PGR of 0.75 Percent	PGR of 1.25 Percent	PGR of 0.25 Percent	PGR of 0.75 Percent	PGR of 1.25 Percent
	Newborns								
Low	28	26	25	41	37	34	48	44	40
Mid	28	26	25	40	37	34	47	43	39
High	28	26	25	39	36	33	46	42	39
Future Generations									
Low	68	55	46	102	83	68	164	133	109
Mid	60	49	41	94	78	63	154	126	103
High	53	44	36	86	70	58	143	117	96
Difference in Lifetime Net Tax Rates of Future Generations and Current Newborns (In percentage points)									
Low	40	29	21	62	46	34	116	90	69
Mid	32	23	16	54	40	29	107	83	63
High	25	17	12	47	35	25	97	75	57
Proportion by Which the Lifetime Net Tax Rate of Future Generations Exceeds That of Current Newborns									
Low	143	112	84	149	124	100	242	202	173
Mid	114	88	64	135	111	85	228	193	164
High	89	69	44	121	94	76	211	179	146

SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: A lifetime net tax rate is the present value at birth of lifetime net taxes as a percentage of the present value at birth of lifetime labor income.

The rates shown are for net taxes at all levels of government combined--federal, state, and local.

Figures are averages for males and females.

The values in the table reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

PGR = productivity growth rate.

a. The low-, mid-, and high-population paths are those used by the Social Security Administration in its 1993 annual report.

ber of future generations varies from 36 percent to 164 percent, and that of the average current newborn varies from 25 percent to 48 percent. The difference between the lifetime net tax rates of future generations and current newborns varies from 12 percentage points to 116 percentage points. That difference translates into having future generations pay lifetime net taxes at a rate that is between 44 percent and 242 percent higher than that of current newborns. The discount rate accounts for most of the variation; productivity and population account for successively less variation, especially for current newborns.

Such uncertainty afflicts any long-term projection. For instance, the Social Security Administration projects that its trust fund will probably go bankrupt by 2030, but that it could grow indefinitely under plausibly optimistic assumptions.⁴

Alternative assumptions change the results predictably. Other things being equal, the higher the discount rate, the higher the difference between lifetime net tax rates of future generations and current newborns. That result will hold as long as the sum of net government debt and the present value of prospective purchases exceeds the present value of net taxes of current generations (which is minuscule in relation to prospective purchases). Essentially, higher discount rates make the bill for future generations compound faster.

By contrast, other things being equal, the higher the growth of productivity or population, the lower the difference in lifetime net tax rates. Higher productivity leads to higher tax collections, but does not increase the benefits of today's retirees. That factor reduces the bill left for the future. It is not reduced by much, however, because the accounts assume that after 2004, government purchases (adjusted for age) would grow at the same rate as output. Higher population (by assumption) would mean a lower ratio of retirees to workers; hence, there would be lower transfers in relation to taxes. That also reduces the bill left for the future.

4. Social Security Administration, *The Annual Report of the Old-Age and Survivors' Insurance and Disability Insurance Trust Fund* (1995).

The lifetime net tax rates of future generations are more sensitive to alternative assumptions than are those of current newborns. That sensitivity reflects the way the accounts define prevailing policy, as well as the influence of compound interest. The accounts assume that current tax and spending rates continue to apply to all living generations, some of whose members may live for 90 years or more. Thus, even apparently slight deviations from a sustainable policy can produce great differences in the results.

Productivity and population do not matter much for the lifetime net tax rate of current newborns. Given the definition of prevailing policy, alternative assumptions about productivity move the net taxes and incomes of current newborns nearly in step, which keeps their lifetime net tax rates fairly steady. An assumption of higher productivity reduces the lifetime net taxes of current newborns because the accounts assign excise taxes to children. Given the nature of the sensitivity exercise, newborns would pay the same excise taxes for 10 years as they would without the higher productivity. But the higher productivity raises their lifetime income. Therefore, their lifetime excise taxes fall in relation to their income. Different population paths change lifetime net taxes of current newborns only because different assumed mortality rates lead to different projected lifespans.

Alternative assumptions for health costs and defense spending could also significantly affect the difference in lifetime net tax rates of future generations and current newborns. For example, suppose that medical costs per patient grew at the rate that the Health Care Financing Administration predicts until 2004, and after that at the rate of productivity growth. Then the reported difference in lifetime net tax rates would fall by about 15 percentage points.⁵ Similarly, the reported difference in lifetime net tax rates would fall by about 10 percentage points if real defense spending grew at the rate that the Office of Management and Budget projects through 2004 and remained at that level afterwards. (Both calculations assume

5. Slower growth in health costs would raise the net taxes of current generations because it would reduce the cash value of transfers they will receive. It is not clear, however, how much rapidly growing health costs represent faster growth in prices or in real services. Therefore, the reduction in net income may pass to providers of health care rather than to patients.

base values for population, productivity, and the discount rate.)

Sensitivity of Policies to Achieve Sustainability

If government purchases were reduced to reach a sustainable policy, how much would the spending cut depend on alternative assumptions? Under the range of assumptions considered, purchases would have to fall by \$165 billion to \$473 billion--a permanent cut of 13 percent to 38 percent (see Table 6). (CBO chose to experiment with purchases because it could do so at far lower computer cost than with taxes or transfers. The numerical results for taxes or transfers would differ, but the pattern of results probably would not.)

A small spending cut is needed when the discount rate is high, even though a high discount rate makes the initial difference in lifetime net tax rates large. The reason is that a higher discount rate makes the bill for the future accumulate faster. Therefore, a spending cut has more leverage when the discount

rate is higher, just as it does when the spending program grows faster. Similarly, when the discount rate is higher, alternative assumptions for population and productivity matter less for the necessary spending cut, but more for the initial difference in lifetime net tax rates.

Sensitivity of Results of Specific Policy Experiments

The policy experiments considered in Chapter 3 do not always yield similar patterns of sensitivity to alternative assumptions. The variation in results can differ among generations and need not be related to what happens to the deficit.

A Policy That Raises the Deficit. The pattern of results for the temporary income tax cut is fairly well defined. For that policy, 15-year-olds incur the greatest cost under base assumptions and experience the most variation under alternative assumptions. (See Figure 3, which shows how much the results vary under alternative assumptions. For instance, the present value of net taxes of 15-year-olds would rise

Table 6.
Hypothetical Proportionate Cut in Government Purchases Required in 1991 to Reach a Sustainable Policy (In billions of 1991 dollars)

Population ^a	Real Discount Rate of 3 Percent			Real Discount Rate of 6 Percent			Real Discount Rate of 9 Percent		
	PGR of 0.25	PGR of 0.75	PGR of 1.25	PGR of 0.25	PGR of 0.75	PGR of 1.25	PGR of 0.25	PGR of 0.75	PGR of 1.25
	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent	Percent
Low	473	435	396	250	231	211	187	176	165
Mid	440	397	351	248	229	207	189	179	168
High	403	353	298	245	224	202	191	180	169

SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

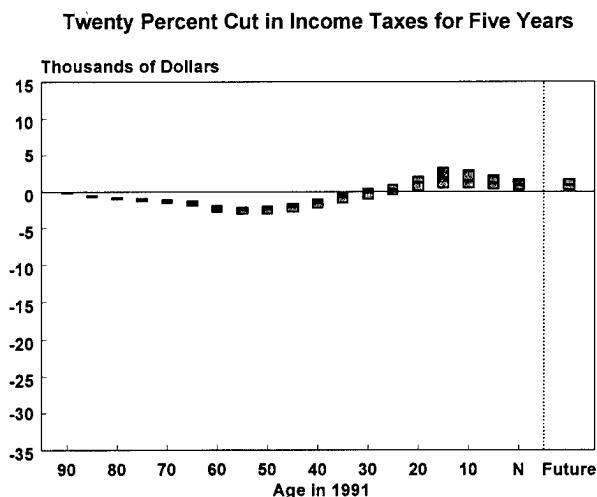
NOTES: A feasible policy is sustainable if it implies no difference in the lifetime net tax rates of future generations and current newborns. The values in the tables reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

PGR = productivity growth rate.

a. The low-, mid-, and high-population paths are those used by the Social Security Administration in its 1993 annual report.

by \$1,870 under base assumptions, but could rise by between \$600 and \$3,300 under alternative assumptions.) The variation lessens progressively as generations are either older or younger than 15 years old. There is little variation for the very old because the change in the net taxes they will pay for the rest of their lives is discounted over a short time.

Figure 3.
A Policy That Raises the Deficit: Variation in Results Under Alternative Assumptions



SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: Change in the present value of net taxes (average for males and females).

The discount rate varies from 3 percent to 9 percent; the growth rate of productivity varies from 0.25 percent to 1.25 percent; and population varies from the low-population path to the high-population path used by the Social Security Administration in its 1993 annual report.

Crossmarks indicate values under the base assumptions: 6 percent real discount rate, 0.75 percent rate of productivity growth, and midpopulation path.

The figures for future generations apply to those born next year. The respective figures for successive future generations would grow at the rate of productivity.

The values in the figure reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

N = newborns.

Different combinations of assumptions tend to shift the results uniformly up or down for current generations. For example, if a set of assumptions yields a change in the present value of net taxes for one current generation that is near the low end of its range of variation, that set will usually do the same for other current generations. That effect is usually true for all the policies considered.

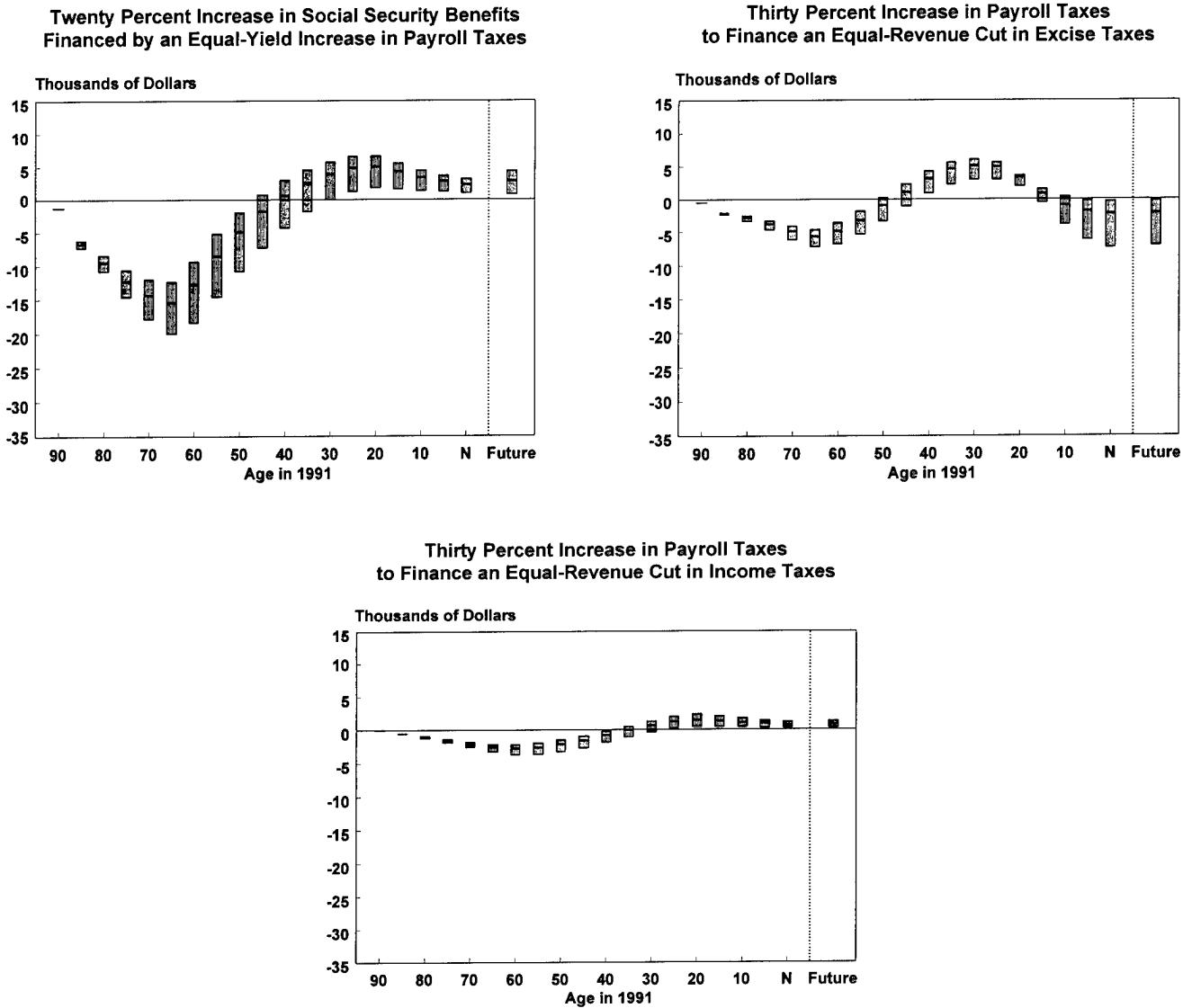
Deficit-Neutral Policy Changes. Alternative assumptions produce more variation when both Social Security benefits and payroll taxes are increased than when the income tax is temporarily cut (see Figure 4). For example, the results for 60-year-olds vary by as much as \$9,000 under the range of assumptions considered for the increase in benefits and taxes (the difference between a fall of \$9,400 and a fall of \$18,400). By contrast, the results for 60-year-olds vary by only \$800 under the temporary tax cut. Unlike the case of the temporary tax cut, the generation whose net resources change the most under base assumptions is not the one whose change in resources varies the most under alternative assumptions. The change is greatest for 65-year-olds, but the variation is greatest for 55-year-olds.

For most older generations, alternative assumptions generate less variation under a shift from payroll taxes to excise taxes than under an increase in benefits and payroll taxes. But the results for the shift in taxes show more variation than for the increase in benefits and taxes for very young and future generations. That result may depend on the fact that the accounts assign part of excise taxes to children.

Replacing income taxes with payroll taxes would cause little variation in results, mostly because the policy would produce slight change overall.

Policies That Reduce the Deficit. Alternative assumptions make the results for these policies vary greatly, especially for future generations (see Figure 5). Differences in the discount rate produce most of the variation. That effect is especially true for future generations as the discount rate moves from 6 percent to 9 percent. Alternative assumptions for population and productivity account for trivial variation for current generations, little variation for future gen-

Figure 4.
Policies That Do Not Affect the Deficit: Variation in Results Under Alternative Assumptions



SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: Change in the present value of net taxes (average for males and females).

The discount rate varies from 3 percent to 9 percent; the growth rate of productivity varies from 0.25 percent to 1.25 percent; and population varies from the low-population path to the high-population path used by the Social Security Administration in its 1993 annual report.

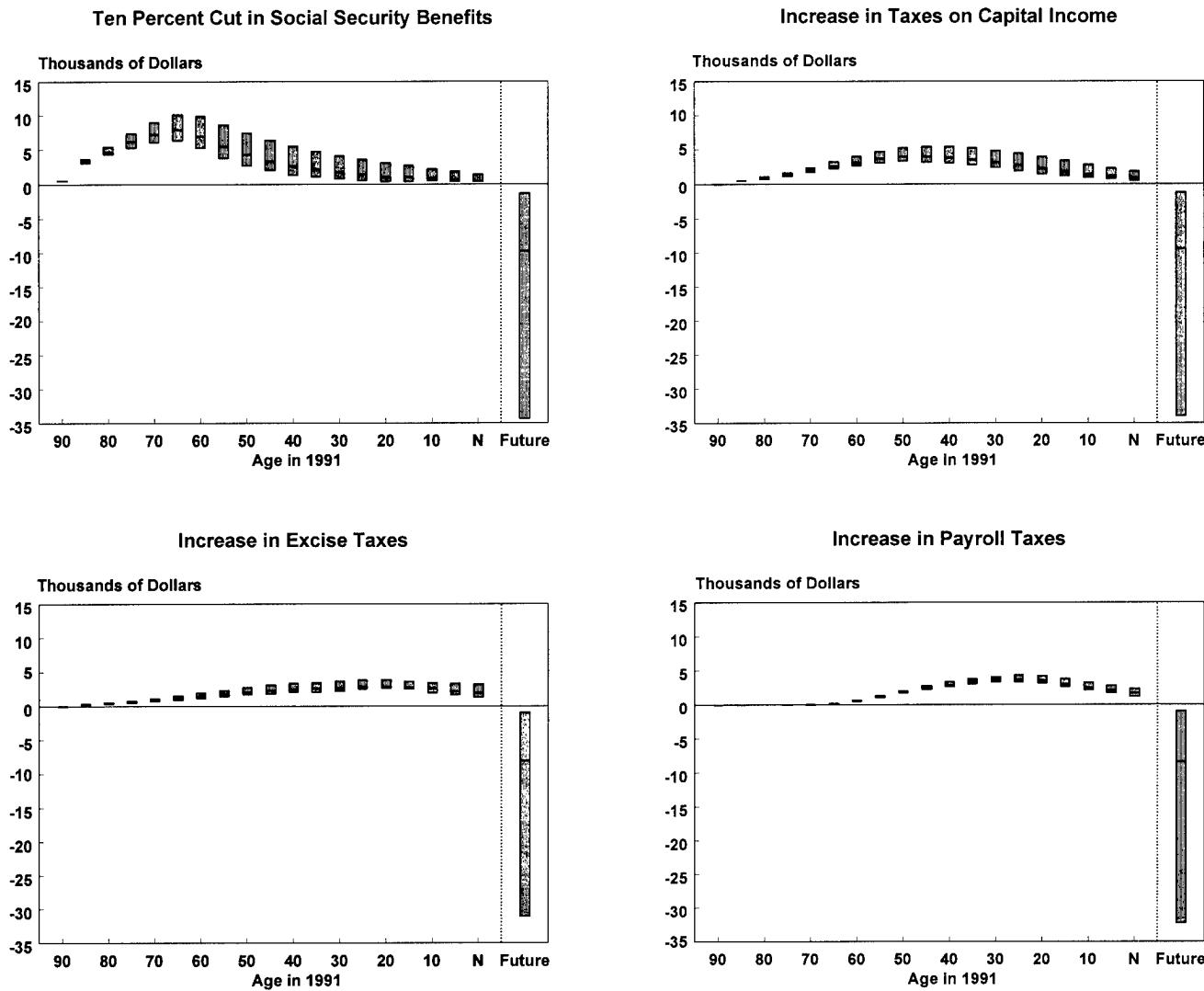
Crossmarks indicate values under the base assumptions: 6 percent real discount rate, 0.75 percent rate of productivity growth, and midpopulation path.

The figures for future generations apply to those born next year. The respective figures for successive future generations would grow at the rate of productivity.

The values in the figure reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

N = newborns.

Figure 5.
Policies That Cut the Deficit by an Equal Amount: Variation in Results Under Alternative Assumptions



SOURCE: Congressional Budget Office, using a computer program and data provided by the authors as described in Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 55-110.

NOTES: Change in the present value of net taxes (average for males and females).

The discount rate varies from 3 percent to 9 percent; the growth rate of productivity varies from 0.25 percent to 1.25 percent; and population varies from the low-population path to the high-population path used by the Social Security Administration in its 1993 annual report.

Crossmarks indicate values under the base assumptions: 6 percent real discount rate, 0.75 percent rate of productivity growth, and midpopulation path.

The figures for future generations apply to those born next year. The respective figures for successive future generations would grow at the rate of productivity.

The values in the figure reflect the implication of generational accounts as constructed, not necessarily the views of the Congressional Budget Office.

N = newborns.

erations at a high discount rate, and much variation for future generations at a low discount rate.

Evaluation of the Sensitivity Results

The sensitivity results are only illustrative. Ideally, the results would yield a numerical statement of the uncertainty inherent in the accounts. For example, a standard method of expressing uncertainty is to state how likely it is that the actual outcome will fall within some range of the predicted outcome. That cannot usually be done because analysts cannot readily assign numbers to most of the sources of uncertainty in the accounts.

But two sources of uncertainty--population and productivity--are more amenable to numerical analysis. Informal analysis suggests that the ranges considered for population and productivity represent a fair description of their uncertainty. (Chapter 5 examines how reasonable is the range considered for the discount rate.)

Population. There is a significant chance that population will grow beyond the bounds examined in this study. Within 10 years, for example, there is about one chance in six that population will be greater than in the high-growth projection, and a similar chance that population will be less than in the low-growth projection.⁶ That assessment is highly tentative because it is based on only about 30 years of forecasting population growth.

Furthermore, the composition of the population, as well as its total, affects the accounts. For example, it matters whether growth occurs among the old because of lower death rates, among the middle-aged because of higher immigration rates, or among the young because of higher fertility rates. Uncertainty about the ratio of retirees to workers may be greater than is implied by the range of population projections considered in this study.⁷

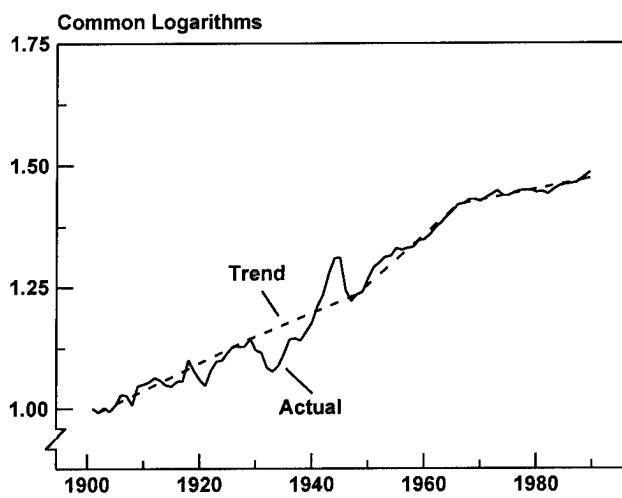
6. Based on unpublished data provided by the Bureau of the Census.

7. Ronald D. Lee and Shripad Tuljapurkar, "Stochastic Population Forecasts for the United States: Beyond High, Medium, and Low," *Journal of the American Statistical Association*, vol. 89, no. 428 (December 1994), pp. 1175-1189.

Productivity. The history of productivity indicates the difficulty of forecasting its growth over long periods. Since 1902, productivity has grown at an average annual rate of 1.3 percent, but that period appears to cover four different epochs of growth (see Figure 6). Productivity grew at an average annual rate of 1.3 percent from 1902 to 1929, 1.2 percent from 1929 to 1948, 2.7 percent from 1948 to 1966, and 0.6 percent from 1966 through 1990. (Those particular years were chosen to determine trend lines because, except for 1966, they contain business-cycle peaks. It is generally agreed that the trend in productivity changed in about 1966.)

Furthermore, growth rates within those epochs sometimes varied considerably. In the most extreme instance, the period from 1929 to 1947 saw a sharp decline in productivity during the Depression, superheated growth just before and during World War II, followed by another decline. Although a repetition of that unusual experience is unlikely, the reasons for the differences in growth epochs are not well understood.

Figure 6.
Productivity and Its Trends
(Real gross national product per worker)



SOURCES: Bureau of the Census, *Historical Statistics of the United States: Colonial Times to 1970* (1975), pp. 126-127, 224; Department of Commerce, Bureau of Economic Analysis; Department of Labor, Bureau of Labor Statistics; Congressional Budget Office.

All in all, a projection of productivity growth of 0.75 percent--the base rate in the accounts after 2004--seems reasonable, but is no more than an extrapolation of the average growth since about 1973. Given the sizable and largely unexplained variations seen in the past, any forecast is uncertain. Based on statistical experiments that CBO has conducted, there might well be one chance in three that productivity growth could fall outside the bounds considered here.

Sensitivity of Results to Other Sources of Uncertainty

Uncertainty in the accounts also arises from their assumptions about the structure of the economy and the incidence of taxes and transfers--that is, who pays or receives their cash value. The relative-age profiles for taxes and transfers, which effectively define the structure of the economy, may change significantly. That would change the results quantitatively, although probably not qualitatively. By contrast, alternative assumptions about incidence could change some results qualitatively as well as quantitatively.

Fixed Relative-Age Profiles

In at least one respect, the assumption of fixed relative-age profiles will certainly be wrong, although that may have only a minor effect. The labor earnings of women will climb as more women work for pay and as their wages and salaries rise in relation to men's. The OMB projection of total labor earnings would contain such information, however. Therefore, the accounts should have the right totals through 2004, but would have them assigned to the wrong groups by age and sex. The results would be numerically wrong, but would probably tell the correct story overall, especially when averaged between males and females.

The assumption of fixed relative-age profiles could be wrong in other ways. For example, as baby boomers have aged, they have not seen their wages grow as fast as their parents did, although the source of that slowdown is unclear. If wages of people who are now young grow faster as they age than did the wages of baby boomers, both young and future gen-

erations will benefit. Of course, such shifts could help or harm any given generation. Thus, the uncertainty for any one generation is greater than that for all generations together.

There is no reason in principle that the accounts must use fixed relative-age profiles. They are simply an expedient in the absence of better information. If enough evidence and data (and need) existed to construct profiles that vary over time, the accounts could accommodate them.

Incidence of Taxes and Transfers

Assumptions about the incidence of taxes and transfers also lead to uncertainty. The accounts are especially open to questions about the incidence of capital income taxes, the "capitalization" of taxes (the way in which the value of an asset reflects the prospective taxes due on its income), and the effect of a change in investment incentives. Different assumptions about those issues would lead to different estimates of the generational effects of policy because the old own most capital.

Economists generally agree about the incidence of excise and payroll or labor income taxes. In the long run, consumers and workers probably pay nearly all of those taxes, as the accounts assume. Little is known about the sliding of transfers (the process by which government benefits substitute for support from family or society). Uncertainty about those issues could be addressed with sensitivity analysis, although this study did not do so.

Taxes on Capital Income. The accounts effectively assume that the supply of capital to domestic business is fixed and that business property taxes are passed to consumers in the same way as sales taxes. But those assumptions are open to question.⁸

8. See Richard A. Kasten and Eric Toder, "CBO's Methodology for Distributional Analysis" (paper presented to the American Enterprise Institute's conference on distributional analysis, December 16, 1993); and Joseph Pechman, *Who Paid the Taxes, 1966-85?* (Washington, D.C.: Brookings Institution, 1985). Corporations could shift the tax to consumers only if competition is imperfect in product markets. Generational accounts essentially assume perfect competition by the way they assign excess taxes to existing capital.

First, capital can cross national borders. Thus, even if the domestic supply of capital is inelastic, the world supply to the domestic market may not be. Owners of capital may therefore shift part of the tax to workers. Second, the property tax on business is generally considered to act more like a tax on capital income than a tax on sales, as the accounts assume. Owners of capital therefore probably bear part of the tax that the accounts assign to consumers.

The net effect of these possibilities on generational distribution is not obvious. In the first case, the old (as owners of most capital) would pay less of the tax and the young (as workers or homeowners) would pay more. But in the second case, the old would pay less and the young or very old would pay more as consumers.

The Capitalization of Taxes. The accounts do not generally reflect the way in which the value of existing capital includes prospective taxes on its income. The problem arises because the law imposes taxes on income from different assets at different rates. For example, income from some assets may be taxed at two levels (corporate and personal), whereas income from other assets (homes or municipal bonds) may be untaxed. The values of those assets will reflect their different tax treatments. Moreover, the assets tend to be owned by people of different ages, so a change in tax treatment will affect different generations differently.

The tax distinction between homes and business capital provides one example. Each type of asset provides a stream of services during its life--shelter in the case of homes and production in the case of business capital. And the market value of the asset will equal the present value of the net returns from the stream of services. But the implicit income from homes is not taxed, whereas the market income from business capital is. Therefore, if the income tax falls, the market value of homes should fall in relation to that of business capital because homes will have lost some of their tax advantage.

The accounts do not include that effect, which would shift resources from current homeowners to current capital owners. Similarly, the accounts do not reflect the fact that a change in the tax rate on

corporate income would directly affect the value of corporate shares, but not other assets, such as savings accounts, bonds, and homes. A rise in the corporate tax rate would therefore shift resources from current owners to prospective owners, as well as to owners of other assets. (The property tax on homes also raises capitalization issues, but that is a local tax, so it is not considered here.)

Issues of capitalization are commonly ignored, especially when analyzing short-run incidence. It may take a long time for their effects to play out, which increases the importance of capitalization in long-term analysis.

Investment Incentives. Generational accounts may also err in their treatment of investment incentives. The accounts rely on the theory that existing capital would suffer a drop in value when an investment incentive rose, in the same way that a bond would if the interest rate rose.

The theory must be modified, however, if a firm incurs significant costs when it changes the amount or mix of its capital. It costs little beyond the purchase price to add a bond to a portfolio, but installing capital entails hidden costs. Doing so may disrupt other work, require oversight that could have gone elsewhere, necessitate training or trial-and-error learning for workers, and so on. Thus, installing capital costs more than just the purchase price; the true cost also includes "adjustment costs"--the costs of diverting resources from other uses. And usually, the larger the investment, the greater the adjustment costs.

Opposing effects are at work. Although the incentive reduces the effective price of investment, adjustment costs raise the cost of installing it. And the added incentive makes any investment that an existing firm has already planned cheaper than it would have been. Therefore, how much added investment incentives will transfer resources from old to young is an empirical matter.

Evidence indicates that the issue is important. One study that assumed an apparently plausible value for adjustment costs suggests that the true cost to the elderly of policies that enhance capital formation

could be about 50 percent of what the accounts report.⁹ More direct evidence suggests that added investment incentives raise, rather than lower, the value of existing firms.¹⁰ If so, added investment incentives make the old better off at the expense of the young rather than the other way around.

The issue matters only for the transfer of resources among young and old; in either case, the added incentive would raise the net taxes of future generations by reducing the total taxes of current ones. (The accounts do not, however, include the effect that the added incentive would have on the size and composition of the capital stock that the future would inherit.) The one-time levy under current law that the accounts assign to current owners is probably appropriate in either case; existing capital has already overcome the adjustment costs of installing it.

The Sliding of Transfers. Little is known about how or how much transfers slide. The few studies that exist suggest that most of Social Security benefits may not slide; that is, they may not significantly reduce support from or increase bequests to others.¹¹

9. Hans Fehr and Laurence J. Kotlikoff, "Generational Accounting in General Equilibrium," Working Paper No. 5090 (Cambridge, Mass.: National Bureau of Economic Research, April 1995).

10. Andrew B. Lyon, "The Effect of the Investment Tax Credit on the Value of the Firm," *Journal of Public Economics*, vol. 38 (1989), pp. 227-247; Thomas W. Downs and Hassan Tehranian, "Predicting Stock Price Responses to Tax Policy Changes," *American Economic Review*, vol. 78, no. 5 (December 1988), pp. 1118-1130; David M. Cutler, "Tax Reform and the Stock Market: An Asset Price Approach," *American Economic Review*, vol. 78, no. 5 (December 1988), pp. 1107-1117; Thomas W. Downs, "An Alternative Approach to Fundamental Analysis: The Asset Side of the Equation," *Journal of Portfolio Management* (Winter 1991), pp. 6-16; and Andrew B. Lyon, "The Effect of Changes in the Percentage Depletion Allowance on Oil Firm Stock Prices," *The Energy Journal*, vol. 10, no. 4 (1989), pp. 101-116.

11. Joseph J. Altonji, Fumio Hayashi, and Laurence J. Kotlikoff, "Is the Extended Family Altruistically Linked? Direct Tests Using Micro Data," *American Economic Review*, vol. 82, no. 5 (December 1992), pp. 1177-1198; and Martin David and Paul Menchik, "The Effect of Social Security on Lifetime Wealth Accumulation and Bequests," *Economic Inquiry*, vol. 58, no. 2 (November 1985), pp. 421-434.

Those studies do not imply that the aged and their children do not already make private transfers between themselves, only that an extra dollar to the aged would not slide to their children.

The study that examined support of the aged, however, considered only elderly people living apart from relatives. Most people who significantly aid old relatives probably do so by taking them into their homes. From 1960 to 1984, the proportion of elderly living independently rose from 55 percent to 76 percent. Much of that rise is associated with an accompanying rise in their incomes, caused in part by higher benefits from Social Security and Medicare. Of course, the elderly typically want to live independently, so higher benefits could have made both them and their children better off.

More sliding seems to take place for public spending on education and health; parents and private groups would otherwise provide some education for children, and doctors and hospitals (and ultimately paying patients) would otherwise forgive the bad debts of needy patients.¹² One study estimates that more public support of nursing home care for the elderly significantly reduces the support that they receive from their children.¹³

12. Robert Lampman and Timothy Smeeding, "Interfamily Transfers as Alternatives to Government Transfers to Persons," *Review of Income and Wealth*, series 29, no. 1 (March 1983), pp. 45-66.

13. David Cutler and Louise M. Sheiner, "Policy Options for Long-Term Care," Working Paper No. 4302 (Cambridge, Mass.: National Bureau of Economic Research, March 1993).

Ambiguities in Generational Accounts

In generational accounts, problems of interpretation arise that cannot be resolved numerically or otherwise addressed within their framework.¹ The choice of discount rate, which is central to the accounts, causes most of the ambiguity. The assumption that prospective income is fixed can bias the results, sometimes substantially. The accounts also suffer from various problems of interpretation that often afflict other tools of analysis. Such issues underscore the need to treat the results of the accounts with care.

There Is No Uniquely Right Discount Rate

Choosing a discount rate raises problems because the accounts must allow for the cost of risk inherent in

prospective streams of net taxes.² Problems of interpretation may also arise because the accounts assume that capital markets are "efficient." That is, the calculation of present value implicitly assumes that everyone can borrow or lend any amount (subject to prospective income) at the given rate of discount.

The Cost of Risk

The discount rate in the accounts can represent more than just the cost of waiting (postponing consumption or net income). There is an additional cost: the risk that net income may be lost, rather than merely postponed. For example, unexpected economic or demographic events may make the total net taxes that government collects lower than expected. In that case, some generations will have to pay more net taxes than scheduled to keep government solvent. Moreover, there is a risk that the mix of taxes and transfers might change--for example, by replacing the income tax with a consumption tax.

1. Many of the points raised in this chapter appear in Robert Haveman, "Should Generational Accounts Replace Public Budgets and Deficits?" *Journal of Economic Perspectives*, vol. 8, no. 1 (Winter 1994), pp. 95-111; Robert Haveman and Christopher Barker, "Evaluating the Generational Effects of Public Policy: Potentials and Pitfalls" (paper presented to the meetings of the Association for Public Policy Analysis and Management, Washington, D.C., October 29, 1993); David Cutler, "Book Review: Generational Accounting," *National Tax Journal*, vol. 46, no. 1 (March 1993), pp. 61-67; Willem H. Buiter, "Generational Accounts, Aggregate Saving and Intergenerational Distribution," Working Paper No. 5087 (Cambridge, Mass.: National Bureau of Economic Research, April 1995); and Dean Baker, *Robbing the Cradle?: A Critical Assessment of Generational Accounting* (Washington, D.C.: Economic Policy Institute, 1995). But also see Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounting: A Meaningful Way to Evaluate Fiscal Policy," *Journal of Economic Perspectives*, vol. 8, no. 1 (Winter 1994), pp. 73-94.

2. Thus, anyone must consider prospective net taxes to be risky. Moreover, the risks of separate generations are interrelated. Both young and old are at risk if they do not know whether deficits will be cut by raising taxes on the young or by cutting transfers for the old.

2. For a discussion of many of the issues that arise, see Robert C. Lind, "A Primer on the Major Issues Relating to the Discount Rate for Evaluating National Energy Options," in Robert C. Lind and Kenneth J. Arrow, eds., *Discounting for Time and Risk in Energy Policy* (Washington, D.C.: Resources for the Future, 1982), pp. 21-94.

As with any other source of risk, uncertainty about net taxes imposes a cost. If people could, they would pay higher net taxes than scheduled if those net taxes were guaranteed, rather than uncertain. That is, people would pay a premium to insure against risk.

The accounts combine in a single discount rate the costs of risk and waiting. Moreover, the accounts apply the same discount rate to all streams of net taxes for all generations. Both of those treatments lead to problems.

Combining the Costs of Risk and Waiting. Ideally, the accounts would treat the costs of risk and waiting separately. Roughly speaking, for each year that a payment is postponed, the cost of waiting accumulates at a constant rate, whereas the cost of risk accumulates at a declining rate. (The cost of waiting for a year is often taken to be the real rate of return on short-term government debt--between 1 percent and 2 percent.) For technical reasons, however, the accounts use a standard expedient and combine the two costs as if the cost of risk also accumulated at a constant rate each year.

Applying the Same Discount Rate to All Prospective Net Taxes. The use of a single discount rate is problematic; people at different ages may not regard the prospective payment of a given tax or transfer as equally risky, and they may not regard a given degree of risk as equally costly. For example, a 70-year-old can probably be more sure of receiving Social Security benefits as currently scheduled than can a 30-year-old. But a 70-year-old may well regard a particular chance of losing the benefits as more costly than would a 30-year-old. There is no reason that these separate effects should offset each other.

In general, therefore, people would not all be willing to pay the same premium to insure against the cost of risk. The amount they would be willing to pay would depend on their age and the particular tax or transfer involved. Moreover, young and future generations will be richer than older generations. Richer generations would assign less cost to a given probability of losing a given amount of net income.

As a result, a single discount rate will typically misstate the present values of net taxes. Further-

more, the error will vary by different amounts for different generations. And it is not possible to use market information to infer the degree of error. People cannot trade claims on prospective taxes and transfers in markets in the way that they can trade claims on prospective income from stocks or bonds.

Interpreting a Discount Rate That Includes a Premium for Risk. Including risk in the discount rate makes the rate of discount greater than the rate of interest on government debt. Holders of government debt need not demand a rate premium to insure against the risk of default (although they must allow for the risk that the real value of the debt may change). They are sure of receiving the dollar amount that is promised, unlike taxpayers, who cannot be sure of paying taxes or receiving transfers at currently scheduled rates. (Some transfers, such as Social Security benefits, however, may be safer than government debt in the sense that they are indexed for inflation.) If net tax revenues fall below what is expected, some taxpayers will have to pay net taxes that are higher than scheduled in order to pay bond-holders what is promised them.

A discount rate higher than the rate on government debt complicates the meaning of a lifetime net tax rate. For example, suppose this year's deficit goes up and raises the lifetime net tax rate of future generations. The extra payment that future generations would have to make would actually accumulate at the government rate of interest. But the accounts make it appear that the extra payment would accumulate even faster if they use a discount rate that is higher than the government rate. Therefore, the higher the discount rate that the accounts use, the higher the lifetime net taxes of future generations that the accounts report.

In effect, the accounts treat the cost of risk that is excluded from the government rate as an implicit tax. Therefore, the lifetime net tax rate reported for future generations reflects two separate effects: the cost of lifetime net taxes that are actually expected, and the cost of risk that they will differ from those that are expected. By using the same discount rate for all generations, the accounts assume that all face the same risk, which appears as an implicit tax.

Finally, a practical issue arises in interpreting the treatment of risk in the accounts. For their base case, the accounts use a discount rate of 6 percent--the historical average rate of return on equity. But that rate is much higher than economists can explain on the basis of equity risk.³ Thus, using that rate to discount prospective net taxes implies that they are far more risky than equity without having any empirical way to justify the choice.

Efficiency of Markets

As an approximation, the assumption of efficient markets may be reasonable for many people, but not for everyone. The assumption is especially unlikely to be true of the temporarily poor--most often the young or unemployed--who expect higher incomes later. Such people may want to consume more than their current income and assets allow, but cannot borrow enough to do so. Even if such consumers could repay a loan out of their prospective earnings, lenders might not extend one because it could not be secured by a real asset. Those consumers are cash-constrained--they cannot consume much more than their current income.

For cash-constrained consumers, present value calculated at a market rate of discount misstates what they think cash flows are worth. Those consumers would be willing to pay a higher-than-market rate of interest to consume more now and less later. They therefore place a higher value on current net taxes and a lower value on prospective net taxes than the accounts would imply.

Perhaps more than one-quarter of the population is cash-constrained, and those people are concentrated among the young. Many studies indicate that a large fraction of consumers, perhaps up to one-half, respond too much to changes in their current incomes and too little to changes in their lifetime incomes.⁴

3. Rajnish Mehra and Edward Prescott, "The Equity Premium: A Puzzle," *Journal of Monetary Economics*, vol. 15, no. 2 (March 1985), pp. 145-162.

4. Robert E. Hall and Frederic S. Mishkin, "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households," *Economica*, vol. 50 (March 1982); John Y. Campbell and N. Gregory Mankiw, "Consumption, Income, and Interest

Moreover, most people cannot borrow at the same rate that they can lend. Those general observations are consistent with cash constraints.

Some economists, however, argue that cash constraints are more apparent than real. Factors other than cash constraints may explain some of the results reported above. For instance, consumers may respond too much to changes in current income because they are short-sighted or follow simple rules of thumb instead of making complex calculations of lifetime income. One study estimates that only 6 percent of the population is actually cash-constrained.⁵ Another argues that cash constraints appear more important in the short than in the long run.⁶ In effect, that argument concludes that lenders would devise new credit instruments to meet the new loan demand that would arise if a change in policy reduced the current and raised the prospective income of the cash-constrained.

But bankruptcy laws make it difficult or costly to devise ways to secure loans against prospective labor or transfer income. Moreover, even if it could be done, it would take time to develop new credit instruments. In the meantime, cash-constrained consumers would remain constrained, and the accounts would misstate the values that they place on their prospective flows of net taxes.

If people are cash-constrained, the accounts are ambiguous. The more important cash constraints are, the more difficult it is to estimate the value that consumers who are not cash-constrained place on current

Rates," in Olivier Jean Blanchard and Stanley Fischer, eds., *NBER Macroeconomic Annual 1989*, vol. 4 (Cambridge, Mass.: MIT Press, 1989), pp. 185-216; Marjorie Flavin, "Excess Sensitivity of Consumption to Current Income: Liquidity Constraints or Myopia?" *Canadian Journal of Economics*, vol. 18 (February 1985); David W. Wilcox, "Household Spending and Saving: Measurement, Trends, and Analysis," *Federal Reserve Bulletin* (January 1991), pp. 1-17; and Stephen P. Zeldes, "Consumption and Liquidity Constraints: An Empirical Investigation," *Journal of Political Economy*, vol. 97 (April 1989), pp. 305-346.

5. Daniel T. Slesnick, "Gaining Ground: Poverty in the Postwar United States," *Journal of Political Economy*, vol. 101, no. 1 (February 1993), pp. 1-38.

6. Fumio Hayashi, "Tests for Liquidity Constraints: A Critical Survey and Some New Observations," in Truman Bewley, ed., *Advances in Econometrics II, Fifth World Congress* (Cambridge, England: Cambridge University Press, 1987), pp. 91-120.

income versus prospective income. And it is even more difficult to do so for the cash-constrained.

The Accounts Assume That Prospective Income Is Fixed

Fiscal policy affects prospective income before tax, but the accounts do not reflect that fact. Policy can do so directly, as when deficits crowd out private assets, or indirectly, as when changes in the mix of taxes and spending affect incentives to work, save, hire, and invest. Because the accounts ignore those long-run effects, they may yield inaccurate--or even misleading--results, especially for young and future generations. (Some economists argue that deficits do not crowd out private assets because people match increases in deficits with increases of private saving. That would ensure that they--or their descendants--would be able to pay the extra taxes that would eventually be needed to pay interest on the extra debt. Most economists find this theory implausible and its evidence unpersuasive.⁷)

Fiscal policies that increase incentives to save or invest act slowly as more assets accumulate to produce more income. Therefore, ignoring such effects should usually introduce larger errors for young and future generations than for older generations.⁸

That conclusion is often true, according to experiments with an economic model that includes the in-

7. See Robert R. Barro, "Are Government Bonds Net Worth?" *Journal of Political Economy*, vol. 82, no. 6 (November/December 1974), pp. 1095-1117; R. Douglas Bernheim, "Ricardian Equivalence: An Evaluation of Theory and Evidence" and accompanying comments and discussion, in Stanley Fischer, ed., *NBER Macroeconomics Annual 1987* (Cambridge, Mass.: MIT Press, 1987), pp. 263-315; and Kent Andrew Smetters, "Ricardian Equivalence: Short-Run Shipwreck; Long-Run Leviathan" (Ph.D. dissertation, Harvard University, 1995).

8. The effect of policy could be greater and more rapid than standard theory predicts if the benefits of a firm's investment spill over to other firms. See Congressional Budget Office, *The Economic and Budget Outlook: Fiscal Years 1990-1994* (January 1989), pp. 79-94.

centive effects of policy.⁹ According to experiments with that model, generational accounts usually provide a good or fair approximation of the actual outcome for all but the very young and future generations. For them, however, the cash value that the accounts report for some policies may be 75 percent of its true value to current newborns and 35 percent to generations in the distant future. In those cases, the accounts establish a lower bound for the benefits of deficit reduction to young and future generations (and an upper bound to the cost that today's adults would have to undergo to reach a sustainable policy). In another instance, however, a change from a proportional to a progressive income tax would make future generations worse off, whereas the accounts would say that they were modestly better off.

In the short run, fiscal policy affects output and pretax income primarily through its effect on demand--directly by changing government purchases, or indirectly by changing people's net taxes. Those short-run effects are transient, however; in about three years, income arrives at the level it would have reached without the short-term stimulus or restraint. Therefore, ignoring the short-run effects of fiscal policy causes little error.

Issues Common to Other Tools of Analysis

Generational accounts, like traditional tools of analysis, ignore some issues that affect the distribution of resources, either among or within generations. Moreover, as with deficit projections, the accounts might reflect any biases or uncertain judgments of those who prepare them.

9. See Hans Fehr and Laurence J. Kotlikoff, "Generational Accounting in General Equilibrium," Working Paper No. 5090 (Cambridge, Mass.: National Bureau of Economic Research, April 1995), from which the discussion draws.

Generational Accounts Ignore Some Issues

The accounts ignore the ways in which government purchases, regulations, and price inflation can distribute resources among generations. In principle, generational accounts could encompass some of those issues, but at the cost of additional complicated and controversial assumptions. The accounts are also silent on issues of equity.

Government Purchases. Generational accounts do not assign the benefits of government purchases to specific generations. If net taxes were raised to pay for purchases, the accounts would assign only the cost of the higher net taxes to various generations; the benefits would be ignored. And the generations that pay the extra taxes may not be the ones that receive the benefits of the extra purchases. By contrast, purchases rose to fight World War II without a fully corresponding rise in net taxes. But the resulting deficits were neither a boon to the generations who fought the war nor a bane to later ones.

For those reasons, the accounts are most informative when they look at a change in the growth of taxes or transfers and there is no change in the growth of government purchases. (Knowing which generations pay, however, does provide half of the answers to questions of distribution by age.)

In the same vein, the accounts assume that an increase in productivity will boost government purchases in the same proportion (other things remaining equal). For that reason, higher growth of productivity does little to reduce the lifetime net taxes of future generations (see Chapter 4). But the accounts ignore the benefits of more government purchases that higher productivity would enable future generations to enjoy.

Trying to assign the benefits of most purchases to specific generations, however, is impracticable. Most government purchases are made to provide public services--such as a legal system or national defense--that are used collectively rather than individually. That makes it virtually impossible to sort out who benefits and by how much. The problem is even more acute when the purchases will yield pro-

spective benefits. For example, today's spending for highways, schools, research, conservation, or defense could yield benefits for many years and to current and future generations.

Moreover, benefits of government purchases can "spill over"--that is, go to groups that do not use them directly. For example, education directly benefits children, but other generations benefit indirectly because the children will be literate when they enter society. Furthermore, much--though hardly all--public spending for education slides to parents and private groups, who would see that children got some education in any case.

The accounts would not accurately reflect the benefits of spending for education even if those benefits did not spill over or slide and were assigned by age. Teaching, like many services, does not seem to grow more productive as rapidly as does the rest of the economy. For example, it now takes a teacher about as much time to explain the rules of grammar to a class as it did at the turn of the century. But schools must raise the pay of teachers about as fast as the pay of workers in the private sector; otherwise teachers would leave the public sector. Therefore, the real spending to educate a child in each successive generation would grow, even if the children received the same education.

The general problem is not unique to the accounts. Benefits are often misstated or measured less accurately than costs. For example, analysts can measure the costs of medicine, education, or pollution control much better than they can measure the benefits. Similarly, the deficit reflects the full purchase cost of a public asset when it is bought, but not the value of its services when it is used; the national income and product accounts measure the cost of government workers, but not the value of their work.

Government Regulations. Government regulations often require spending by one group to benefit others. For example, safety and environmental regulations make firms spend money to benefit their workers or the public at large. But it is not always clear who pays. A regulation can act as an excise tax if the firm passes the extra cost to consumers, or as a tax on specific capital and labor if the firm moves abroad or goes out of business. Nor is it always clear who ben-

efits or by how much. For instance, pollution controls may disproportionately benefit young asthmatics, old heart patients, or future generations.

Government regulations may also favor some groups at the cost of others without requiring spending. For example, import quotas, acreage allotments, and marketing orders favor selected producers (and perhaps their workers or suppliers) at a cost to their customers. Similarly, a law that made firms charge premiums for health insurance without regard to age would favor the old at the expense of the young.¹⁰ And the military draft imposed costs--sometimes dire--on young men to serve the country as a whole.¹¹

Inflation. A change in the rate of inflation can redistribute resources among generations because it changes the relative values of existing assets and liabilities. If inflation rises unexpectedly, borrowers gain and lenders lose because the real value of interest and repayment is less than either expected. In particular, higher-than-expected inflation reduces the real value of government debt. Such a reduction benefits future generations at the expense of current bondholders.

Even if people fully expect higher inflation, its interaction with tax law can lead to changes in asset values. Lenders have to pay tax on the inflation premium--the additional return that would keep their real assets whole--so the effective rate of tax on their real income rises. By contrast, implicit income from owner-occupied housing remains untaxed, giving homes a better tax advantage than before. Thus, the market value of homes would fall in relation to that of debt claims.

Among current generations, the effects of higher inflation--expected or unexpected--tend to favor the young at the expense of the old. The young are likely to be borrowers and homeowners rather than lenders and bondholders. Of course, if inflation comes down, those effects work in the other direction.

Equity. The accounts cannot determine what distributions among generations are fair. For example, the accounts cannot in themselves address the following questions: if future generations will be better off than current newborns, should future generations pay net taxes at higher lifetime rates? Do future generations owe a special debt to the generations that won World War II or the Cold War? Should baby boomers be given special consideration because their numbers reduced the growth of their lifetime incomes below the trend? Questions like those can be answered only with value judgments.

Furthermore, the accounts treat only the average member of each generation; they do not consider distribution by income or wealth, either within or among generations. Averages can be misleading because income, and especially wealth, is unevenly distributed. For example, reducing Medicaid spending for prenatal visits would benefit future generations, on average, but not those unborn who would need the visits. (It is possible, however, to construct the accounts so that they treat distribution according to both age and income of the living.)

Generational Accounts Can Ignore Reality

By design or default, generational accounts may not reflect reality. Like deficit projections, the accounts can be manipulated and will contain only the information that humans put into them.

Generational Accounts Can be Manipulated. It is at least as easy to present optimistic generational accounts as it is to present optimistic deficit forecasts. For example, the Gramm-Rudman-Hollings law set deficit targets to balance the budget by 1991, and generational accounts would have reported a substantial reduction in the lifetime net taxes of future generations. But the law did not specify how to meet those targets. That task was left to future Congresses, which failed to hit the targets. So the reported reduction in lifetime net taxes of future generations would not have materialized.

Moreover, it would be possible to manipulate policy in a way that would make generational ac-

10. Congressional Budget Office, *An Analysis of the Administration's Health Proposal* (February 1994).

11. See Baker, *Robbing the Cradle?* p. 24.

counts, but not the deficit, misleading. For example, suppose a policy specified higher spending for 10 years, followed by permanently lower spending. Such a policy could be chosen so that generational accounts showed lower lifetime net taxes for future generations, whereas 10-year projection showed higher deficits. The accounts would be misleading if the spending cuts turned out to be as elusive as the Gramm-Rudman-Hollings targets.

It is also possible to get different results from the accounts by constructing them differently. For example, the accounts would report much lower lifetime net taxes for every generation if they assigned the benefits of spending for education as a transfer to the young. (The lifetime net tax rates of future generations and current newborns, however, would drop by similar amounts--an identical amount if real spending per pupil is projected to grow at the same rate as productivity. Thus, the difference in lifetime net tax rates of future generations and current newborns might change little or not at all.) Or an alternative version of the accounts might assign by age the costs of inflation or unfunded mandates. In fact, if

the accounts were used in official budget presentations, there would probably be as many proposed adjustments to them as there are to the deficit.

Generational Accounts May Reflect Limited Foresight. As with any other calculation, generational accounts do not have to be right just because they come out of a computer. The accounts use mechanical rules to consolidate and extrapolate official projections. If those rules or projections do not accurately reflect the probable state of the world, neither will the accounts. If the best information is not there to begin with, the accounts will not add it.

For example, if the Office of Management and Budget had not foreseen that a savings and loan crisis was probable, the accounts would not have included the expected liability associated with it. Similarly, past forecasts of medical costs have consistently been too optimistic. The accounts cannot anticipate the liabilities of the Pension Benefit Guaranty Corporation or foresee unpredictable events, such as disasters or discoveries.

Chapter Six

Conclusion

As with most tools of policy analysis, generational accounts offer a useful perspective, but serve as an imperfect indicator. The accounts can often suggest a rough magnitude and general pattern of results, but uncertainty and ambiguity would always remain.

The accounts present a great deal of information in a compact way. Furthermore, they reduce the results to appealing dimensions--one-time cash payments or lifetime net tax rates. At the same time, however, the accounts hide the details that produce the results. For that reason, and because the results must be interpreted with care, the accounts only serve as a guide to further analysis or consideration.

Even with their limitations, the accounts stress three concerns that should inform policy analysis. First, they estimate the way in which policy directly distributes resources among generations. The effort to form that estimate highlights what is reasonably known about the effects of policy by age and what is left to learn. Second, the accounts use the zero-sum constraint to pose issues in terms of sustainable policy. Using the constraint shifts focus from arbitrarily chosen goals, such as current deficit targets, to ultimate limits on government. Furthermore, the con-

straint enables the accounts to represent future generations explicitly. Third, the accounts expose the issue of economic and policy risk, which is not accounted for in the rate of interest on government debt. To ignore issues of risk would bias policy choices by giving too much weight to estimates of prospective payments and receipts.

But the accounts rest on unresolved issues and present an incomplete picture. Although it is not clear what discount rate to choose--or even whether a single rate is appropriate--the numerical results depend importantly on that choice. And in seeking to show the effect of today's fiscal policy on young and future generations, the accounts omit the mechanism that most analysts emphasize--borrowing today reduces income tomorrow. The loss of prospective income caused by current deficits might be twice as large as the purely budgetary effects on which the accounts focus.

Those conditions lead the Congressional Budget Office to conclude that generational accounts should not take a place with its regular budget baselines. Instead, CBO regards the accounts as a tool for examining broad policy options, rather than as an accounting statement.

Appendices

Is the Zero-Sum Constraint Necessary?

According to standard theory, the ratio of debt to output would threaten to grow out of control if government did not observe the zero-sum constraint. The ratio might remain stable under a less stringent condition, however. In that case, the lifetime net taxes of future generations under prevailing policy would be much lower than generational accounts state. But it would be a gamble at best to rely on that possibility.

What Does the Zero-Sum Constraint Imply?

In terms of present value, imposing the zero-sum constraint is the same as requiring that the debt be retired at some time (or that interest be paid from taxes rather than further borrowing). The zero-sum constraint requires that an increase in debt be matched in present value by an increase in future net taxes. But the increase in debt is simply the present value of its interest and repayment (if it is ever repaid). Therefore, paying the higher net taxes in the future is equivalent in present value to either retiring the debt or paying the interest forever.

In traditional analysis, the zero-sum constraint is necessary if the interest rate on debt is greater than the growth rate of output. To illustrate, suppose that there is an initial debt and that the "primary deficit" (the deficit excluding interest payments) is zero. With a primary deficit of zero, current net taxes

would exactly pay for current purchases. But the ratio of debt to output would rise; the debt would grow at the rate of interest, and output would grow at a lower rate. Furthermore, a vicious cycle would start because the higher debt would require higher interest payments, which would make the debt grow even more in relation to output, which would raise the interest rate, and so on.

Keeping debt from growing in relation to output would require a primary surplus equal to the interest on the debt. A primary deficit of that amount would require a permanent increase in net taxes equal to interest on the debt. Being equal, they would have the same present value, which is simply the value of the debt. That condition is just the zero-sum constraint--the higher net taxes needed to maintain stability are equivalent in present value to retiring the debt.

Why Does the Zero-Sum Constraint Matter?

In principle, some conditions might enable government to keep the ratio of debt to output stable when "rolling over" the debt; that is, government could forever issue new debt to pay interest on old instead of raising net taxes (or cutting purchases) to pay interest. In that case, each generation would inherit debt from previous generations, add to it, and pass it to

following generations. In present value, the debt would never be retired.

Traditionally, economists have thought that two conditions would make persistent rollover feasible. First, the rate of interest on debt must be lower than the rate of growth of output. Second, the primary deficit must not be too large as a share of output. To illustrate, suppose the interest rate is less than the growth rate, and the primary deficit is zero. Then the ratio of debt to output will fall because debt grows at the rate of interest, whereas output grows at a higher rate. If the primary deficit was greater than zero, it would also add to debt. Consequently, the ratio of debt to output could remain stable--neither rise nor fall--if the primary deficit was greater than zero, as long as it was not too much greater. (Of course, the debt would still displace capital that the public would otherwise own.)

More recently, some economists have considered models in which rollover is feasible even if the interest rate is greater than the growth rate. That possibility arises when public debt gives people a chance to pool risk in a way that private markets cannot.¹ Holding public debt is less risky than holding private assets. If private markets cannot satisfy the demand for less risky assets, public debt provides a link for pooling risk between current and future generations.

One observation suggests that this could be the case. Compared with bonds, equity shares seem to earn far too high a rate of return to justify the difference on the basis of their relative risk.² (Alternatively, the price of equities is too low in relation to that of bonds to explain easily the difference on the basis of risk.) Thus, there could be an unfilled demand for less risky assets that private markets cannot satisfy, although other factors might also explain the observation.

Clearly, whether or not the zero-sum constraint is necessary matters a great deal. If it is, current generations will have to contribute more or future generations will have to pay a huge bill. But if the zero-sum constraint is not necessary and the primary deficit is not too big, all future generations could pay net taxes at the same lifetime rate as current newborns and roll over the debt. Neither current nor future generations would ever have to make a sacrifice.

Can We Roll Over Debt?

Although it might succeed, trying to roll over the debt would be a gamble. So imposing the zero-sum constraint is like buying generational insurance.³ Debt incurred now irrevocably commits the government to make payments (as interest or repayment of debt). If rollover turned out not to be feasible, the government could make the payments when they came due only by reducing spending or raising net taxes. Reducing debt (and implicit obligations) now reduces the risk that this choice will be forced on society later.

A number of considerations suggest that a roll-over policy would be risky. First, the interest rate has been above the growth rate since about 1980, and the Congressional Budget Office projects that it will remain so for the foreseeable future. Of course, those forecasts are highly uncertain, and the interest rate may fall below the growth rate. But history suggests that such a result cannot be relied upon.⁴

Second, the interest rate could rise above the growth rate in many periods even if it remained below the growth rate on average. Given a very long time horizon, it becomes virtually certain that the interest rate will exceed the growth rate for a long enough time to bankrupt the government if it flouts the zero-sum constraint by running primary deficits.

1. Olivier Blanchard and Philippe Weil, "Dynamic Efficiency, the Riskless Rate, and Debt Ponzi Games Under Uncertainty," Working Paper No. 3992 (Cambridge, Mass.: National Bureau of Economic Research, February 1992).

2. Rajnish Mehra and Edward Prescott, "The Equity Premium: A Puzzle," *Journal of Monetary Economics*, vol. 15, no. 2 (March 1985), pp. 145-162.

3. This analogy appears in Laurence Ball, Douglas W. Elmendorf, and N. Gregory Mankiw, "The Deficit Gamble," Working Paper No. 5015 (Cambridge, Mass.: National Bureau of Economic Research, February 1995).

4. Ibid.

Third, it is not clear whether public debt fills an unmet demand for less risky assets and makes rollover feasible. The general conditions under which it is feasible are not known; there are only specific theoretical examples of economies for which it is feasible, and their relevance to the U.S. economy is not clear.

In any case, rollover is not feasible under prevailing policy; the primary deficit would grow too large

in relation to output to allow rollover even if the rate of interest remained below the rate of growth. Moreover, the rate of interest is not necessarily the cost of transferring resources between periods, even if it is the relevant rate for stability of the debt. If risk makes the cost of transferring resources between periods greater than the rate of growth, rollover may be undesirable even if it is feasible.

How Generational Accounts Treat Taxes on Income from Capital

The accelerated depreciation allowances of the tax code imply that income from existing capital is taxed at a higher rate than income from new capital (investment). Thus, generational accounts must adjust prospective taxes on income from capital in order to assign them to the right generations.

The same logic also applies for an investment tax credit because it is a special case of accelerated depreciation. That is, given an investment tax credit, the current tax rate on economic income is higher for existing than for new capital. (Investment tax credits do not apply under current law but have applied in the past.)

Tax Law Treats Income from New and Existing Capital Differently

The current annual tax rate on "economic income" from a unit of capital rises as it ages and eventually exceeds the statutory rate. (Economic income is capital income after subtracting economic depreciation--actual depreciation adjusted for inflation.) At first, accelerated tax depreciation allows firms to deduct more than economic depreciation. That shields economic income from tax and reduces the current tax rate. But as accelerated allowances are used (and as inflation erodes their real value), firms must deduct an ever-smaller share of economic depreciation. That exposes an ever-larger share of economic income to tax and raises the current tax rate. The current rate stops rising when tax depreciation allowances are used up, and by then it exceeds the statutory rate.

Firms cannot avoid higher current tax rates by selling existing capital to each other or by selling existing capital and buying new capital. If they did, they could start deducting tax depreciation on the capital they bought as if it were new. But the tax code has recapture and antichurning rules that make such a scheme unprofitable. (And investment tax credits in the past have effectively applied only to newly made capital.) Therefore, the accounts assume that firms never sell existing capital because the law makes the tax come out as if they never do.

But people can buy and sell shares in firms that own existing capital. Because the economic income of existing capital is taxed more heavily than that of new capital, owners and buyers assign a lower value to a firm's existing capital than to otherwise equivalent new capital. The difference in value is the present value of the higher taxes to be paid on the income from existing capital over its life.

Generational Accounts Allow for the Difference in Treatment

In order to sort out the effects of investment incentives among generations, the accounts use the concepts of "normal" and "excess" taxes.¹ (The terms describe what tax law implies; they do not suggest that the normal rate is the "right" rate or that taxes on existing capital are "too high.")

Defining Normal and Excess Taxes

Normal taxes are defined by the taxes to be paid over the life of new capital. That is, the normal tax rate is the present value of taxes on income from new capital as a percentage of the present value of its economic income. Normal taxes each year are the taxes that would be paid on economic income at the constant normal rate. If tax depreciation matched economic depreciation, the normal rate and each year's current rate would equal the statutory rate. But under current law (and rates of inflation), the current tax rate is below normal in early years and above normal later (because firms can deduct more than economic depreciation early and less than economic depreciation later). And the normal rate is below the statutory rate because present value gives more weight to earlier, below-normal taxes than to later, above-normal taxes.

Excess taxes each year are the difference between that year's actual taxes and normal taxes. Thus, excess taxes are negative early in the life of the capital and positive later. By the nature of the tax law, the present value of excess taxes on existing capital is always positive (assuming inflation is positive). Moreover, by the nature of its construction, the present value of prospective excess taxes at any time is equal to the negative of the present value of past excess taxes. (When the capital is new, the present value of its excess taxes is zero. Therefore, the pres-

ent values at any time of past and prospective taxes must cancel each other.) That is, taxes paid at a rate below normal will have to be made up later with interest.

Assigning Taxes on Income from Capital

To assign prospective taxes on income from capital under current law, the accounts break it into two conceptual parts. The first is a one-time levy; it is the present value of excess taxes on income from now-existing capital. According to the accounts, the levy in 1991 amounted to \$684 billion, which is prorated to current owners. The second is an annual flow; it is the tax that would be collected each year if the normal rate applied to income from all capital, existing now or installed later. The flow is prorated to prospective owners (including current owners who continue to hold their capital).

The adjustments account for all prospective taxes on income from capital. Current owners pay all excess taxes and pay normal taxes for as long as they hold their capital. All later owners (including current owners who buy more) pay taxes at the normal rate; they will have bought either new capital or old capital at a discounted price.

The adjustments also account for cases in which later buyers subsequently sell. Whether they bought new or then-existing capital, they will have paid a price that reflected the present value of taxes at the normal rate. And at the time they sell, the present value of prospective excess taxes is simply the negative of the present value of past excess taxes. The effect, therefore, is the same as if all later buyers always pay taxes at the normal rate.

A change in law that raises investment incentives also raises excess taxes on income from existing capital; its prospective taxes remain as before, but the normal rate falls. That raises the present value of excess taxes for current owners and reduces the annual tax at the normal rate for prospective owners. Thus, according to the accounts, the increase in incentives transfers resources from current owners (mostly old) to prospective owners (mostly young).

1. See Alan J. Auerbach, Jagadeesh Gokhale, and Laurence J. Kotlikoff, "Generational Accounts: A Meaningful Alternative to Deficit Accounting," in David Bradford, ed., *Tax Policy and the Economy*, vol. 5 (Cambridge, Mass.: MIT Press, 1991), pp. 67-69 and 93-96.

The Roles of Generational Accounts and the Standard Budget Accounts

Some advocates propose that debate over fiscal policy should focus on how it would affect generational accounts rather than the reported deficit. But arguments for that proposal overstate the merits of generational accounts and the faults of the deficit. Each measure addresses relevant issues that the other does not. Therefore, information provided by generational accounts could complement, but not displace, that provided by the deficit.

The Case for Generational Accounts

Some proponents argue on empirical and theoretical grounds that generational accounts are relevant to policy debate and the deficit is not. Empirically, proponents claim that generational accounts show the degree of fiscal stimulus better than does the deficit. Theoretically, they maintain that the reported deficit is ill defined and that generational accounts are well founded.

Empirical Issues

Traditionally, economists believe that several elements of the standard budget accounts indicate the short-term thrust of policy. The deficit indicates the pressure on interest rates by showing how much gov-

ernment is borrowing in capital markets. Spending and taxes indicate pressure on the economy by showing how much government purchases are adding to total demand and how much net taxes are taking from people's incomes.

Yet many studies find no link between deficits and interest rates, and advocates claim that no such link exists because the deficit is ill defined.¹ Furthermore, they argue that current after-tax income is a poor guide to how much people currently consume. Instead, the life-cycle model (a standard theory) concludes that as people grow older each year, other things being equal, they consume a greater fraction of their remaining resources (present value of prospective net income).

Advocates of generational accounts say, therefore, that the deficit does not show whether fiscal policy is tight or loose. They would call a policy loose not if it raises the deficit, but if it sends lifetime resources to generations who consume them at a high rate. The advocates conclude that because generational accounts track resources by age, they indicate how policy affects current consumption better than do the budget accounts.

1. Laurence J. Kotlikoff, *Generational Accounting: Knowing Who Pays, and When, for What We Spend* (New York: The Free Press, 1992), pp. 65-87.

Theoretical Issues

According to proponents of generational accounts, the deficit is ill defined because it depends arbitrarily on the way that government labels its payments and receipts.

The Social Security system provides an example. In a legal sense, contributions are taxes and benefits

are transfers. But the system could also be viewed as a compulsory savings program for workers because they contribute expecting to receive benefits when they retire. If the system were a compulsory savings program, contributions might legally be labeled as loans to government and benefits might be labeled as payment of interest and principal.

Box C-1. How Labels Can Affect Measures of Fiscal Policy

Suppose that the government starts a new program that will collect \$100 from Ms. A in 1995 and repay it in 2005. For convenience, the interest rate is assumed to be zero. The government might label the new payments and receipts in any number of ways. For example, it might label:

- o The \$100 received in 1995 as taxes, and the \$100 paid in 2005 as transfers;
- o The \$100 received in 1995 as borrowing, and the \$100 paid in 2005 as return of principal; or
- o The \$100 received in 1995 as \$200 of borrowing less \$100 of transfers paid, and the \$100 paid in 2005 as \$200 of return of principal less \$100 of taxes received.

The reported deficit in either year may rise, stay the same, or fall even though the net cash flows are the same in each case (see table below). In the first case, the extra \$100 of taxes in 1995 reduces the deficit (additional debt) by the same amount. Similarly, the extra \$100 of transfers paid in 2005 increases the deficit by the same amount.

In the second case, nothing happens to the deficit in either year. In 1995, the government issues \$100 of debt in exchange for the extra \$100 it receives from Ms. A. But that extra \$100 received offsets what the government would otherwise have borrowed from someone else. Therefore, the deficit in 1995 remains as it would have been without the program. Similarly, the return of principal in 2005 offsets what the gov-

Examples of How the Government Deficit Could Depend on Labeling (In dollars)

Case	Label	1995		2005		Effect on Deficit
		Change in Cash Flow to Government ^a	Effect on Deficit	Label	Change in Cash Flow to Government ^a	
Case 1	Taxes	100	-100	Transfers	-100	100
Case 2	Borrowing	100	0	Return of principal	-100	0
Case 3	Borrowing Transfers	200 <u>-100</u>	0 <u>100</u>	Return of principal Taxes	-200 <u>100</u>	0 <u>-100</u>
	Total for Case 3	100	100	Total for Case 3	-100	-100

SOURCE: Congressional Budget Office.

NOTE: Table shows government receipts from and outlays to a given person in two different years under alternative labels.

a. Government receipts (cash flow to government) are positive; government outlays (cash flow from government) are negative.

The policy is the same in either case: people make the same payments, receive the same benefits, face the same incentives. But the reported deficit is not the same. In the first case, higher prospective benefits do not raise the current deficit. In the second case, however, the promise to pay higher benefits later would increase the deficit because it would increase government's unfunded obligations. Therefore, the current deficit depends on whether govern-

ment labels its receipts as taxes or borrowing and its payments as transfers or payment of principal and interest.

In principle, the example of Social Security is not unique. For example, taxes for unemployment insurance could be labeled as borrowing to provide prospective unemployment compensation, whereas unemployment compensation could be called interest

Box C-1.
Continued

ernment would have paid to those from whom it would otherwise have borrowed in 1995. Thus, the deficit in 2005 remains as it would have been in the absence of the new policy.

In the third case, the deficit rises in 1995 by the amount of transfers and falls in 2005 by the amount of taxes. Neither the borrowing in 1995 nor the return of principal in 2005 affects the deficit, as they do not in the second case.

The third case may seem contrived because Ms. A pays and receives money in the same year, but such exchanges happen. For example, students pay excise taxes and receive loans through the government; investors buy government bonds and shares in corporations that receive tax breaks; and retirees pay taxes,

buy government bonds, and receive Social Security benefits.

By contrast, labels do not affect generational accounts because they are stated in terms of present value. Using the previous example, generational accounts would be the same even if the labels were different (see table below). Given that the interest rate is zero, \$100 is the 1995 present value of the government's extra net receipts in 1995 and net payments in 2005.

Of course, the generational accounts for Ms. A simply mirror those of the government. That is, \$100 is the 1995 present value of her extra net payments in 1995 and net receipts in 2005.

Examples of How the Generational Accounts Do Not Depend on Labeling (In dollars)

Case	Label	1995		2005		
		Change in Cash Flow to Government ^a	Present Value in 1995	Label	Change in Cash Flow to Government ^a	Present Value in 1995
Case 1	Taxes	100	-100	Transfers	-100	100
Case 2	Borrowing	100	-100	Return of principal	-100	100
Case 3	Borrowing	200	-200	Return of principal	-200	200
	Transfers	<u>-100</u>	<u>100</u>	Taxes	<u>100</u>	<u>-100</u>
	Total for Case 3	100	-100	Total for Case 3	-100	100

SOURCE: Congressional Budget Office.

NOTE: Table shows government receipts from and outlays to a given person in two different years under alternative labels.

a. Government receipts (cash flow to government) are positive; government outlays (cash flow from government) are negative.

and repayment of principal. Excise taxes for gasoline could be labeled as borrowing to provide highway travel. The change in labels may have no legal basis, but that does not matter for the economic functions that the tax and spending programs serve. Indeed, from an economic perspective, the government could choose labels that would enable it to report any given current deficit for any given fiscal policy.² By contrast, only one set of figures could be reported for generational accounts under any given policy, regardless of labels (see Box C-1 on page 60).

The possibility of changing labels has some practical significance. For example, a recent proposal to establish family savings accounts (FSAs) represented a change of labels. FSAs are equivalent in present value (and economic effect) to individual retirement accounts (IRAs). FSAs exempt interest earned in the account from tax; IRAs exempt the contribution but tax the withdrawal. Compared with an FSA, an IRA raises the deficit initially (because the contribution is tax-exempt) and reduces the deficit later (because the withdrawal is taxed). The incentive to save and the eventual effect on government finances are the same; only labels and deficits are different.

As currently constructed, generational accounts cannot show the effects of FSAs or IRAs any better than the standard budget accounts. In fact, the effects of deferred taxes on IRAs are so small that generational accounts do not even keep track of them, although they could be adapted to do so if such effects were large enough to be significant.

Generational accounts, however, are not entirely immune from arbitrary labeling. They depend on whether spending is called a transfer or a purchase: transfers reduce net taxes, whereas purchases do not. For example, in 1985, the Department of Commerce (the labels of which are generally accepted by the accounts) relabeled spending for Medicaid as a transfer rather than a purchase of medical services for the poor. In the 1991 base year, that difference in labels reduced current net taxes by \$100 billion--about 10

percent of the total. By contrast, the change in labels did not affect deficits, current or prospective.

The Case for the Standard Budget Accounts

Although the charges leveled at the deficit have some merit, they do not justify the claim that the standard budget accounts are irrelevant. The debt and deficit remain relevant in fact and in theory.

Empirical Issues

The argument that the deficit is misleading as a measure of fiscal stimulus depends on empirical evidence. That is, how much do deficits affect interest rates, and how well does the life-cycle model predict consumption?

The debt and deficit provide more information about interest rates than the advocates of generational accounts claim. Studies that use monthly or quarterly data usually fail to find a systematic link between the deficit and short-term interest rates. But studies that use yearly data usually find a significant link between the debt and long-term interest rates.³ In any case, no evidence indicates that generational accounts would do better.

The deficit is even more clearly relevant for consumption. The life-cycle model, although broadly consistent with the data, does not fully explain how much people consume.⁴ Perhaps as many as half of consumers respond more to changes in current income and less to changes in lifetime income than the

2. See Kotlikoff, *Generational Accounting*, pp. 149-163, or Laurence J. Kotlikoff, "From Deficit Delusion to the Fiscal Balance Rule," Working Paper No. 2841 (Cambridge, Mass.: National Bureau of Economic Research, March 1989).

3. Congressional Budget Office, "Deficits and Interest Rates: Theoretical Issues and Empirical Evidence," CBO Staff Working Paper (January 1989).

4. See Franco Modigliani and Arlie Sterling, "Government Debt, Government Spending, and Private Sector Behavior: Comment," *American Economic Review*, vol. 76 (December 1986), pp. 1168-1179; Martin Feldstein and Douglas Elmendorf, "Government Debt, Government Spending, and Private Sector Behavior Revisited: Comment," *American Economic Review*, vol. 80 (June 1990), pp. 589-599; and Roger C. Kormendi and Philip Meguire, "Government Debt, Government Spending, and Private Sector Behavior: Reply and Update," *American Economic Review*, vol. 80 (June 1990), pp. 604-617.

life-cycle model predicts.⁵ As a practical matter, changes in the deficit record changes in current cash flows between government and the people. For that reason, the deficit helps explain consumption because it indicates current income.

In some cases, changes in cash flows may not alter people's behavior. For example, government payments to honor obligations for deposit insurance raised the deficit, but did not change the asset position of depositors. Such cases can readily be identified, however, and budget reports can be presented to reflect such conditions--as CBO has done.

Experience following the Social Security Amendments of 1983 suggests how generational accounts could misstate short-term policy stimulus. According to generational accounts, the amendments cost workers at the time about \$1 trillion--the increase in present value of their net taxes.⁶ The life-cycle theory predicts that workers should have permanently reduced their annual consumption by a fraction of the \$1 trillion. For example, by one estimate, a loss of \$1 trillion in the value of private assets would reduce consumption and raise saving by about \$80 billion a year.⁷

But there is no clear evidence that the amendments had any effect at all on consumption. If not, there may be two explanations, neither of which is encompassed by generational accounts. First, people might have been short-sighted, so they disregarded the prospect of lower after-tax incomes. But using generational accounts to predict how much people consume today assumes that they are far-sighted and

that they forecast and discount all prospective income and outgo. Second, people might have expected the law to pass and have changed how much they worked or consumed accordingly before the amendments became law. But generational accounts are based on prevailing, not expected, policy.

Theoretical Issues

The argument that the deficit is irrelevant also fails theoretically.⁸ Even if all their ideal assumptions are granted, generational accounts could not fully state the effect of fiscal policy, and the deficit would remain relevant.

For example, generational accounts assume that prevailing policy applies to everyone now living. But most people know that prevailing policy cannot last; nor do they expect it to. Trying to follow the rates of taxes and spending that were current in 1994 would severely disrupt the economy well within the lives of most current generations.⁹ Therefore, at least some current generations will probably have to pay a larger share of the bill than is now scheduled.

Moreover, people's expectations regarding how, how much, and when they will have to pay will affect how, how much, and when they work, save, hire, and invest. For example, if they expect prospective payroll taxes to rise, they may decide to work more now and retire earlier. If they expect prospective taxes on capital income to rise, they may decide to consume more now (save less) and consume less later. Therefore, estimates of generational accounts under prevailing policy do not show the effect of policy because they do not indicate how people expect policy to evolve.

5. Robert E. Hall and Frederic S. Mishkin, "The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households," *Economica*, vol. 50 (March 1982); John Y. Campbell and N. Gregory Mankiw, "Consumption, Income, and Interest Rates," in Olivier Jean Blanchard and Stanley Fischer, eds., *NBER Macroeconomic Annual 1989*, vol. 4 (Cambridge, Mass.: MIT Press, 1989), pp. 185-216; Marjorie Flavin, "Excess Sensitivity of Consumption to Current Income: Liquidity Constraints or Myopia?" *Canadian Journal of Economics*, vol. 18 (February 1985); David W. Wilcox, "Household Spending and Saving: Measurement, Trends, and Analysis," *Federal Reserve Bulletin* (January 1991), pp. 1-17; and Stephen P. Zeldes, "Consumption and Liquidity Constraints: An Empirical Investigation," *Journal of Political Economy*, vol. 97 (April 1989), pp. 305-346.

6. Kotlikoff, *Generational Accounting*, p. 182.

7. Laurence H. Meyer and Associates, *The WUMM Model Book* (St. Louis: L.H. Meyer and Associates, June 1994).

8. The following paragraphs draw from Allan Drazen, "Problems of Government Accounting: A Comment," in Allan H. Meltzer and Charles I. Plosser, eds., *Carnegie Rochester Conference Series on Public Policy*, vol. 37 (December 1992), p. 90; Henning Bohn, "Budget Deficits and Government Accounting," in Allan H. Meltzer and Charles I. Plosser, eds., *Carnegie Rochester Conference Series on Public Policy*, vol. 37 (December 1992), pp. 6-18; and Willem Buiter, "Public Debt in the USA: How Much, How Bad, and Who Pays?" Working Paper No. 4362 (Cambridge, Mass.: National Bureau of Economic Research, May 1993), pp. 29-36.

9. General Accounting Office, *The Deficit and the Economy: An Update of Long-Term Simulations* (April 1995).

The fact that prevailing policy cannot last also implies that labels still matter. If they did not, it would make no difference whether government made living generations pay more by raising net taxes or by defaulting on its debt (or by selectively taxing people who hold debt). But sovereign default is out of the question; it is the last resort of a bankrupt regime, not the rational choice of a stable polity. Therefore, people will react differently to debt--the explicit promise to pay interest and principal--than they will to an implicit promise to levy a tax or pay a transfer. Indeed, that is the reason that advocates of generational accounts argue that prospective net taxes entail more risk than government debt. (The federal government could indirectly default through inflation. But it could not selectively reduce the real value of its debt or tax the holders in the same way that it can selectively change the real value of net taxes.)

Debt constrains the behavior of government. The implicit promise to levy a tax or pay a transfer is reversible, but the explicit promise to repay debt is irrevocable. For instance, government might label a promise to make a future payment as either debt or a prospective transfer. And it is possible in theory to

choose labels that make either promise equally risky when it is made. But events that occur between the times the promise is made and the payment is due may force the government to reduce its payments. The labels determine which promise the government must honor; they establish whether government can make a choice now and reverse it later. Such a constraint affects how government can act and how people expect it to act--effects that generational accounts do not recognize.

Conclusion

The claim that the deficit is irrelevant stems from a theoretical result that requires ideal conditions not seen in the real world. The result suggests interesting lines of research that may eventually deepen our understanding of the ways in which policy and the economy work. But generational accounts cannot inform policymakers to the exclusion of the deficit; the deficit contains relevant information that generational accounts do not. Thus, generational accounts might complement but cannot replace the deficit.

How Generational Accounts Were Developed Under Alternative Economic and Demographic Assumptions

The Congressional Budget Office used a conservative method to determine how sensitive the accounts are to alternative assumptions about population, productivity, or the discount rate. The procedure involved extending official projections of alternative population paths, running the program that calculates the accounts under alternative assumptions, and adjusting the results for each alternative to make them comparable with each other.

Extending Alternative Population Projections

CBO extended the population projections of the Social Security Administration by the same method used for the base case in the accounts. The accounts extend the mid-growth projection to 2200 by assuming that the rates of birth, death, and immigration in 2080 would continue to prevail through 2200. Those rates are such that the projections of both total population and its composition by age and sex would remain nearly constant through the 22nd century. Total population would reach 370 million in 2080 and 388 million in 2200. After 2200, it is assumed that both total population and its composition by age and sex would remain at the values estimated for 2200.

To extend the low- and high-growth paths, CBO assumed that the rates of birth, death, and immigration for the midgrowth path in 2080 would prevail on the other paths through 2200. That assumption eventually holds population stable on both paths. Until 2080, population would fall to 286 million on the low-growth path and rise to 489 million on the high-growth path. After 2080, population on the low-growth path would fall to 260 million in 2125, then rise to 288 million by 2200. After 2080, population on the high-growth path would rise slowly to 526 million in 2200. For both paths it was assumed that after 2200, total population and its composition by age and sex would remain at their values for 2200.

Projecting Taxes and Transfers

CBO assumed that the total of each real tax or transfer would grow as projected by the Office of Management and Budget (OMB) for 10 years. After 10 years, real taxes and transfers for the average person of each age and sex are assumed to grow at the same rate as productivity. Thus, after 10 years, real growth of the respective totals would depend on growth of productivity and population.

The method that CBO used understates the influence of alternative assumptions for productivity and population. In practice, different productivity or population assumptions within the 10-year horizon of the OMB forecast would generate different projected totals for most taxes and transfers. But the method used only allows alternative assumptions about productivity or population to affect the growth of projected totals after 10 years have passed.

Although the method understates sensitivity to productivity and population, it does not qualitatively affect the results. Experiments show that if all taxes and spending vary immediately with population and productivity, differences in the discount rate still account for most of the differences in results.

Adjusting the Results

The results must be adjusted to make them comparable because they start from different bases. For example, consider what happens to the average 30-year-old man when a 20 percent increase in Social Security benefits is financed by payroll taxes. The present value of his prospective net taxes rises by \$8,200 when the discount rate is 3 percent and by \$7,400 when it is 6 percent. (Both cases assume that productivity grows at 0.75 percent and population follows the midgrowth path.) The raw increase in present value is greater when the discount rate is 3 percent.

But the man's resources differ in the two cases. Human capital--the present value of prospective labor income--is \$938,000 when the discount rate is 3 percent, but only \$545,000 when it is 6 percent. His stream of labor income is the same in both cases, but it is given less weight by the higher discount rate.

Total resources--human capital plus other assets--amount to \$967,000 when the discount rate is 3 percent and \$555,000 when it is 6 percent. Hence, the increase in the present value of the man's net taxes is greater in relation to his resources when the discount rate is 6 percent.

Similar issues arise when productivity or population differs from its base value. For example, faster growth in productivity raises the growth of labor income and, hence, human capital. By contrast, faster population growth reduces human capital because the assumed higher death rate reduces the probability that people will live to any given age.

CBO adjusted the results so that they are all comparable to the base case--6 percent discount rate, 0.75 percent average annual productivity growth, and midgrowth population path. In the example above, the raw change in present value of net taxes of the average 30-year-old man is 0.85 percent of total resources when the discount rate is 3 percent. Therefore, the adjusted result is \$4,700, which is 0.85 percent of total resources for the base case. Results for all generations under all alternative assumptions are adjusted in the same way.

This method is not unique, of course. For example, if a 3 percent discount rate was the base, the results for the 3 percent case would remain unadjusted at \$8,200, and the adjusted results for the 6 percent case would become \$12,900--1.3 percent of \$967,000.

No adjustment is needed when results are expressed in terms of lifetime net tax rates. In that case, results for the average member of each generation are already given directly as a percentage of resources (human capital) at birth.